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DEEP-SEA GALATHEID CRUSTACEANS (ANOMURA: GALATHEIDAE) COLLECTED BY THE 'CIDARIS I' EXPEDITION OFF CENTRAL QUEENSLAND, AUSTRALIA

KEIJI BABA

Baba, K. 1994 06 01: Deep-sea galatheid crustaceans (Anomura: Galatheidae) collected by the 'Cidaris I' Expedition off central Queensland, Australia. *Memoirs of the Queensland Museum* 35(1): 1-21. Brisbane. ISSN 0079-8835.

A collection of deepsea galatheid crustaceans obtained by the 'Cidaris I' Expedition off the Central Queensland Shelf contains 20 species, five of which are described as new: *Bathymunida inermis*, *Munida alia*, *M. declivis*, *M. rubridigitalis*, and *Munidopsis cidaris*. *Galathea inconspicua* Henderson, 1885 is recorded for the first time since the unique male holotype taken by the 'Challenger' off Banda Island. The ranges of 13 species are extended. □*Crustacea, Anomura, Galatheidae, deepsea, Australia, Indo-West Pacific.*

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In 1986, under the research project "The deep-sea benthos off the Great Barrier Reef Shelf and adjacent Coral Sea", 113 deepsea stations were worked by the 'Cidaris I' (Dr M. Pichon, Cruise Leader). Crustaceans from the samples obtained have been studied by Bruce (1989, 1990), Crosnier (1988), Macpherson (1990), Richer de Forges & Guinot (1990) and Poore & Bardsley (1992). The present material comprises 112 specimens in 24 lots taken from 15 stations in depths ranging between 296 and 1609m. They are divided among 20 species of the Galatheidae.

Twenty-two species of the Galatheidae have hitherto been known from Australia (Stimpson, 1858; Haswell, 1882a, 1882b; Miers, 1884; Henderson, 1885, 1888; Whitelegge, 1900; Grant & McCulloch, 1906; Balss, 1921; McNeill, 1926, 1968; Hale, 1927; Boone, 1935; Lewinsohn, 1967; Haig, 1973, 1974; Baba, 1986). Many of these are shallow-water inhabitants, and the deep-sea forms (occurring in transitional depths) are represented by only five species: four of *Munida* and one of *Galathea*. There is no previous record for the deepsea *Munidopsis* from Australia. Among the 20 species reported herein, 18 are recorded for the first time from Australia, including five new species (one of *Bathymunida*, three of *Munida*, one of *Munidopsis*). No chirostylids are included in the collection, although six (one *Chirostylus*, one *Eumunida* and four *Uroptychus*) are known to occur in Australian waters (Henderson, 1888; Haig, 1974; Baba, 1986; de Saint Laurent & Macpherson, 1990).

Measurements are shown in parentheses under the heading of 'Material Examined', indicating the postorbital carapace length. The material is deposited in the Queensland Museum, Brisbane (QM).

SYSTEMATICS

Bathymunida Balss, 1914
Bathymunida inermis sp. nov.
(Fig. 1)

MATERIAL EXAMINED

HOLOTYPE: ovig. ♀ (3.0mm), QMW19702, Sta. 42-2 (17°21.77'S, 146°48.52'E), 303-296m, sledge, 15 May 1986.

PARATYPES: Same data as holotype, 8 ♂ (2.6-3.9mm), 10 ovig. ♀(3.3-3.7mm), 3 ♀ (2.7-3.8mm), QMW19701.

ETYMOLOGY

From the Latin *inermis* (unarmed) alluding to the lack of spines on the dorsal surface of the carapace.

DESCRIPTION OF HOLOTYPE

Carapace, excluding rostrum, about 1.5 times as wide as long; dorsal surface convex from side to side, unarmed, transverse ridges as figured; cervical groove distinct, its dorsal midpoint slightly posterior to midlength of postorbital carapace length; in profile, gastric region moderately inflated, preceded by distinct depression, cardiac region medially elevated, border between branchial and cardiac regions also elevated. Lateral margins posteriorly divergent to point somewhat posterior to anterior cervical groove, convergent posteriorly from this point. Anterolateral spine well developed, directed

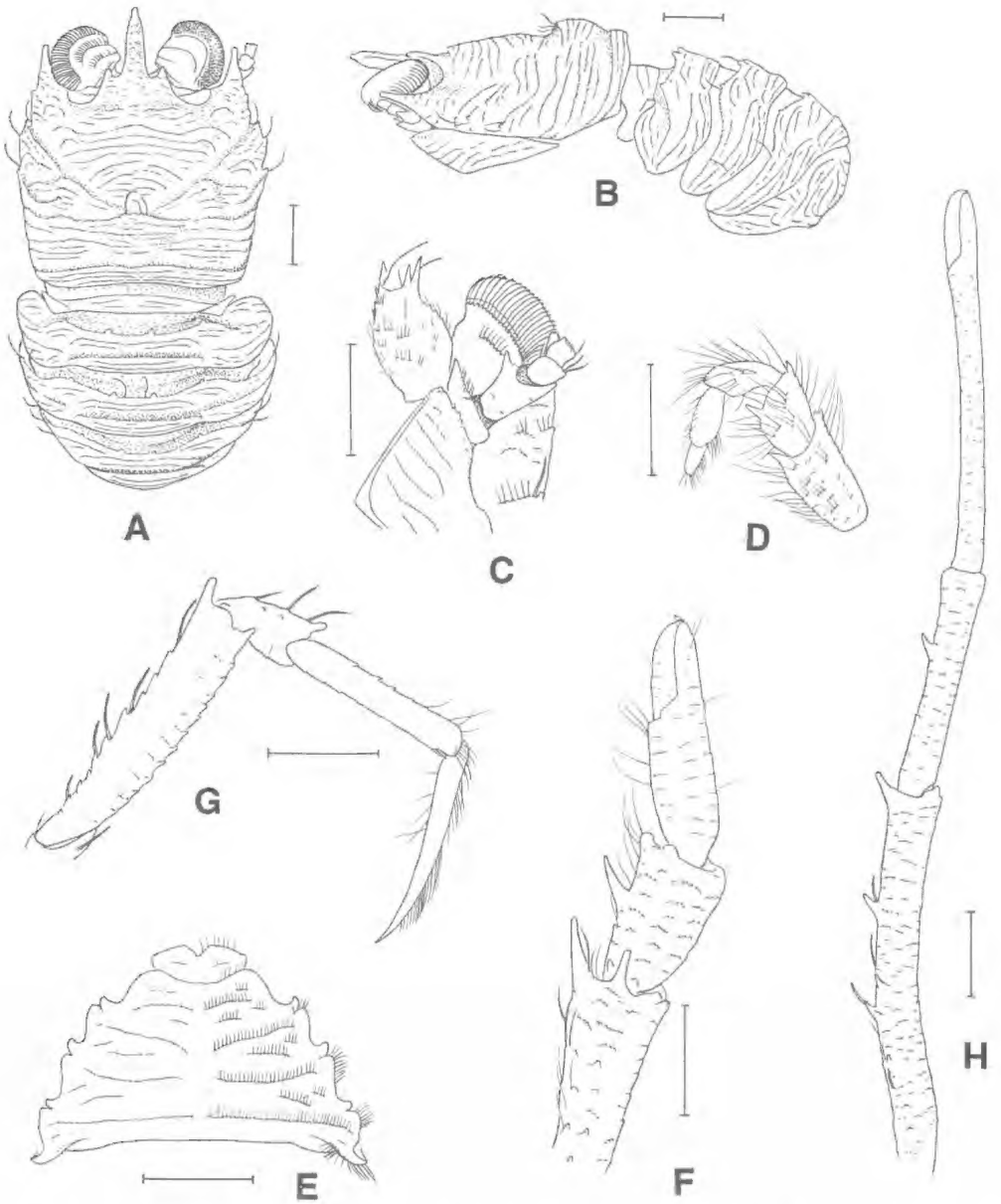

FIG. 1. *Bathymunida inermis* sp. nov. A-G, ovigeous female holotype; H, male paratype (carapace length, 3.5mm). A, carapace and abdomen, dorsal view; B, same, lateral view, tailfan omitted; C, anterolateral part of cephalothorax, showing antennular and antennal peduncles, ventral view; D, endopod of left third maxilliped, lateral view; E, sternal plastron; F, right cheliped, dorsal view; G, right first walking leg, lateral view; H, right cheliped, dorsal view.Scales = 1mm.

straight forward, overreaching supraocular spine, followed by small process directly behind it; branchial lateral margin behind cervical groove with a few reduced spines and crenulations; long fine setae sparse on anterior median part of cardiac region and anterior part of branchial lateral margin.

Rostrum overreaching end of cornea, much wider than supraocular spines; directed slightly upward, moderately compressed laterally, ending

in blunt tip, dorsally with fine tubercles, midlaterally ridged. Supraocular spines very short, 0.15 times as long as, and, not distantly remote from rostrum.

Transverse ridges on abdominal segments as illustrated; second through fourth segments each with 4 short blunt spines on anterior ridge.

Eyes dilated, depressed, with fringe of long setae near base of cornea.

Basal segment of antennule relatively short, with denticular spines on distal half of mesial and lateral margins, distolateral margin with dorsoventrally bifid spines somewhat longer than distomesial one. Antennal peduncles partly visible in dorsal view, placed beneath anterolateral spine of carapace; first segment with ventral distomesial margin produced into spine not longer than second segment, second segment with distomesial and distolateral spines, former acute and shorter, latter directed straight forward, ending in blunt tip.

Third maxillipeds typical of genus, ischium elongate, flexor margin with stout distal spine, extensor margin with 1 or 2 small distal spines; merus short, flexor margin with sharp median spine, extensor margin with well-developed distal spine accompanied proximally by a few denticular crenulations.

Sternal plastron as illustrated.

Chelipeds similar, 2.3 times as long as postorbital carapace length; mesially provided with fine plumose setae, dorsally and ventrally with scale-like granulate ridges. Merus equally wide as carpus, but much wider than chela (distal 2 segments), terminally armed with well-developed mesial, somewhat smaller dorsal, and very small blunt lateral spines, dorsally with small spines roughly in row. Carpus with 2 mesial marginal spines; distal one terminal in position, as wide as proximal, but short, ending in blunt tip; proximal one at midlength, acute. Propodus 0.76 times as wide as carpus, 2.2 times as long as wide, unarmed. Fingers 0.8 times as long as palm, not gaping, distally sharp, curved and crossed.

Walking legs relatively slender, with iridescent, fine plumose setae along extensor margins except for distal segment; first walking leg reaching midlength of dactylus of cheliped. Meri similar on first and second walking legs but longer on first, extensor margin with line of short inclined spines on first and second walking legs (terminal one prominent on first leg, small on second leg), unarmed on third leg; flexor margin with short terminal spine followed proximally by denticles on first 2 legs, no terminal spine on third leg. Carpus having extensor margin with blunt distal spine, paralleling row of a few denticles or denticular processes on dorsolateral surface. Propodus 0.84 times as long as dactylus on first leg, equally long on second and third legs, extensor margin with a few denticles on first and second legs, flexor margin with slender distal spine distinct on first and second legs, absent on third. Dactylus slender, curved as figured, extensor margin with relatively long coarse setae, flexor margin smooth, with sparse setae proximally.

Variation and Differences between Sexes

All paratypes agree with the holotype, except for one ovigerous female having cheliped carpus with additional spine proximal to midmesial marginal spine. Males differ from females in having cheliped carpus and propodus both relatively long and slender, especially in large males (length-width ratios of carpus 1.7-2.4 in females, 2.6-2.9 in small males (2.6-2.7mm), 7.2 or 8.0 in large males (3.6- 3.7mm); those of propodus 2.0-3.1 in females, 4.3-7.6 in small males, 13.4 in large males); propodus and fingers much narrower than carpus. Chelipeds 2.3-2.4 times as long as postorbital carapace length in small males and all females, 3.5 times longer in large intact male. First walking leg fully reaching end of cheliped in ovigerous females, terminating at distal end of carpus in large males, but in small males ranging from reaching end of propodus to almost midlength of finger.

Remarks

Six species of *Bathymunida* are known to date: *B. aspinirostris* Khodkina, 1981, from Norfolk Island Ridge in 51m; *B. balssi* Van Dam, 1938, from Seram Sea in 118m; *B. brevirostris* (Yokoya, 1933), from Japan in 105-106m (Baba, 1970: 59); *B. longipes* Van Dam, 1938, from Bali Sea near Kangean Group and Sulu Archipelago in 100-140m; *B. polae* Balss, 1914, from the Red Sea and Madagascar in 150-255m (Baba, 1990: 952); and *B. quadratirostrata* Melin, 1939, from the Bonin Islands in 128- 183m. Baba (1990: 952) suggested that *B. polae* and *B. balssi* may be identical.

Several important characters separate *B. inermis* from all other species of *Bathymunida*: 1, strong dorsal spines on the carapace (on the gastric and cardiac regions in particular) are absent; 2, the supraocular spines are much closer to the very stout rostral spine; 3, the transverse ridges on the carapace are more distinct; 4, the

chela is much narrower than the carpus and merus. These characters (only except for the last) do not fit the definition of the genus given by Balss (1914). However, due to the large number of shared characters unique to *Bathymunida*, the present species is provisionally placed in this genus. These are: the orbital margin is so strongly concave that the orbit is largely visible in a dorsal view; the second, third and fourth abdominal tergites bear 4, 2, 2 spines on the anterior ridge; the third thoracic sternite is anteriorly strongly produced, with the entire posterior margin usually contiguous with the anterior margin of the following sternite; distal two segments of the endopod of the third maxilliped, and even the merus, are reduced in size; the dactyli of the walking legs are slender and nearly smooth without spines on the flexor margin. *Bathymunida* will be revised in a series of studies on New Caledonian material now in progress.

The longer chelipeds displayed by large males may not be aberrant, because examples of this are also known in *B. polae* (see Baba, 1990: 952).

Galathea Fabricius, 1793
Galathea pubescens Stimpson, 1858

Galathea pubescens Stimpson, 1858: 252; Baba, 1988: 76 (synonymy and references).

MATERIAL EXAMINED
Sta. 42-2 (17°21.77'S, 146°48.52'E), 303-296m, sledge, 15 May 1986: 1 ♂(3.4mm), QMW19703.

REMARKS
This specimen has a less spinose and less setose carapace, as noted earlier for some specimens from the Philippines (Baba, 1988: 76) as well as from the East China Sea (Baba, 1988: 77). This is one of the few species of *Galathea* that are found in the deepsea.

RANGE
Previously known from Japan, East China Sea, Philippines, Western Australia and Zanzibar, in 40-494m. Recorded for the first time from eastern Australia.

Galathea inconspicua Henderson, 1885
(Fig. 2)

Galathea inconspicua Henderson, 1885: 408; 1888: 122, pl. 12, fig. 2.

MATERIAL EXAMINED
Sta. 42-2 (17°21.77' S, 146°48.52'E), 303-296m, sledge, 15 May 1986, 1 ovig. ♀(5.0mm), QMW19704.

DESCRIPTION
Carapace, excluding rostrum, 1.2 times as long as wide, dorsal surface with distinct setiferous ridges as illustrated; 8 small spines on epigastric region and 2 spines on each lateral protogastric region. Lateral margins slightly convex, with 9 spines on each side; 2 in front of cervical groove; first anterolateral (preceded by 2 small spines mesial to it); second small, with accompanying spinules (1 dorsal and 3 or 4 ventral to it, ventralmost somewhat larger); third to ninth behind cervical groove; fifth, sixth and ninth very small.

Rostrum very narrowed distally, length fully more than half that of remaining carapace; lateral teeth anteriorly diminishing in size, anteriormost situated somewhat anterior to midlength of rostrum.

Pterygostomian flap lacking spine on surface and anterior margin.

Orbit sharply delimited laterally by small anterolaterally directed spine, ventrolateral margin with line of 3 or 4 small teeth.

Eyes somewhat depressed and elongate, mesial and lateral margins slightly convex, eyestalks with fringe of short setae near cornea.

Second and third abdominal segments each with 4 transverse ridges.

Antennular basal segment with very reduced mesial terminal spine, well-developed lateral terminal spine, stronger dorsal spine and a few very small lateral marginal spines proximal to dorsal one; terminal segment with tuft of pronounced setae on distodorsal margin. Antennal peduncle having first segment with well- developed distoventral process ending in sharp point reaching nearly to end of second segment, second segment with distolateral spine much longer than distomesial spine; third segment with distomesial and distolateral spines, both very small, latter rather dorsal in position.

Ischium of third maxilliped with well-developed spine on flexor distal margin and small one on extensor distal margin, mesial ridge with 20 or 21 denticles. Merus with 3 spines on flexor margin; proximal one well developed, situated about at midlength; distal one distinctly smaller than proximal one, terminal in position; median one very small, somewhat proximal to midpoint between these; extensor margin with small spine at distal end.

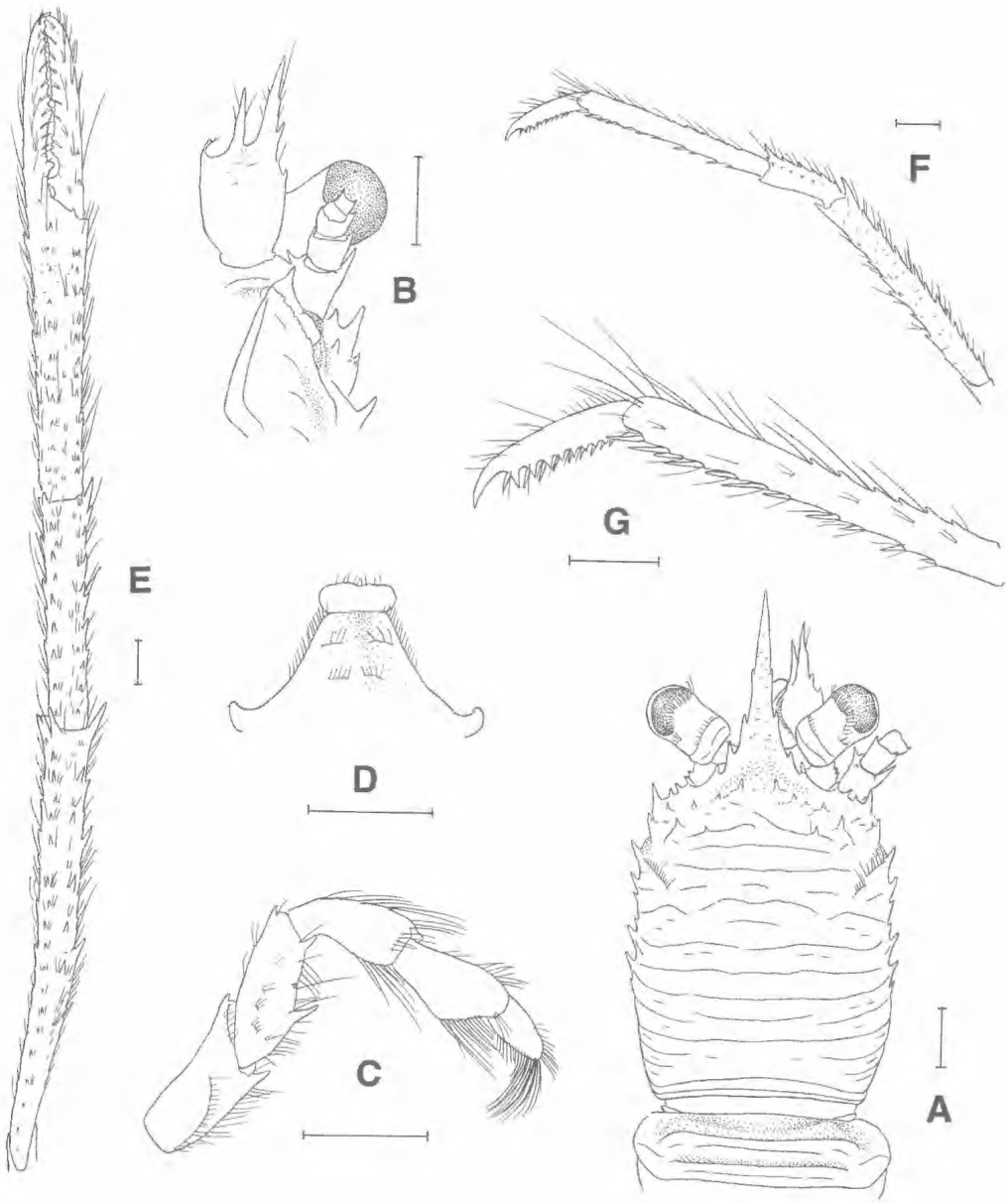

FIG. 2. *Galathea inconspicua* Henderson, ovigerous female from Station 42-2. A, carapace and anterior abdominal segments, dorsal view; B, anterolateral part of cephalothorax, showing antennular and antennal peduncles, ventral view; C, endopod of right third maxilliped, lateral view; D, anterior part of sternum; E, left cheliped, dorsal view; F, left first walking leg, lateral view; G, distal two segments of same, lateral view. Scales = 1mm.

Anterior part of sternum as figured; third thoracic sternite roughly quadrangular; fourth thoracic sternite 3.1 times as wide as preceding, relatively long, width 1.9 times length of anterolateral margin.

Chelipeds slender, fully more than 5 times as long as carapace excluding rostrum; sparsely provided with fine setae. Spination in dorsal view as illustrated; 4 rows of spines (2 dorsal, 1 lateral, 1 mesial) on merus, carpus and propodus, mesial

terminal spine on merus much pronounced. Carpus 6 times as long as wide, more than half length of merus, bearing no prominent spines but somewhat larger distal one on mesial margin. Propodus distally somewhat wider, slightly longer than carpus, 6 times as long as wide. Fingers three-fourths as long as palm, somewhat gaping proximally, distally fitting to each other (when closed) with a few intermeshing teeth; opposable margins with line of tubercles on distal two- thirds, proximally with pronounced basal process. Ventral surface of cheliped with 2 rows of spines on merus, scattered spinules on carpus and palm, and larger distoventral spine on carpus.

Walking legs also slender and sparsely setose. First walking leg overreaching end of merus but barely reaching midlength of carpus of cheliped. Meri posteriorly diminishing in size; extensor margin with 14, 13, 9 spines on first, second, third walking legs, respectively; flexor margin with 7 or 8 spines, terminal of these much larger. Carpus with row of 7 small extensor marginal spines paralleling another row of small spines on lateral face. Propodus about 11 times as long as wide, slightly more than twice as long as dactylus, extensor margin with 5 or 6 small spines on proximal half on first and second legs, nearly none on third, flexor margin with 10 or 11 slender spines (excluding distomesial) on first, 9 or 11 on second, 10 on third. Dactylus ending in sharply curved claw preceded by 9 or 10 rather erect teeth decreasing in size proximally, each tooth with corneous setae arising from its base.

Epipods present on chelipeds, absent from walking legs.

Remarks

This specimen is referred without doubt to *G. inconspicua*, the identification verified by examination of the male holotype in the collection of the Natural History Museum, London (BM1888:33). The holotype is now in poor condition, lacking all pereopods.

The spination of the carapace illustrated by Henderson (1888: pl. 12, fig. 2) is not correct; the epigastric row of 6 spines in the holotype is somewhat more posterior in position, accompanying a lateral protogastric spine posterior and lateral to lateral extremity of this row, and the lateral marginal spines are rather distinct, only lacking the hindmost (eighth) as in the present specimen; there are some minor discrepancies between the type and the present specimen: in the type the carapace is wider, the length-width ratio (excluding the rostrum) being 1.08; the merus of the third maxilliped on the right side (detached and missing on the left) bearing three spines as described by Henderson (the median one being prominent). The presence of epipods on the chelipeds, the spinose anterior gastric region, the basal antennular segment having a reduced distomesial spine, and the carpus of the cheliped lacking prominent mesial marginal spines, link the species strongly to *G. albatrossae* Baba, 1988 from the Philippines and the Ryukyus (Baba, 1988:65; 1989:128). The latter, however, has the carapace with fewer lateral marginal spines, the triangular rostrum distally not strongly narrowed, the chelipeds shorter relative to the carapace, the walking legs having fewer flexor marginal spines on the propodus (at most four) and dactylus (six), and the anterior part of the sternum longer relative to width (the fourth thoracic sternite being 2.7 times as wide as the preceding sternite, its width 2.8 times the length of its lateral margin).

The full description provided above will complement the brevity of the previous descriptions of the type material by Henderson (1885, 1888).

Range

Off Banda Island and eastern Australia, in 296-659m. This is the first record for the species since that of the unique holotype from 'Challenger' Station 194.

Munida Leach, 1820
Munida alia sp. nov.
(Fig. 3)

Material Examined

Holotype: ovig. ♀ (9.2mm), QMW19705, Sta. 52-2 (18°04.16'S, 147°17.17'E), 490-512m, beam trawl, 18 May 1986.

Etymology

From the Latin *alius* (another), alluding to the other species of a group centered around *Munida heteracantha*.

Description Of Holotype

Carapace 1.09 times as long as wide, when measured from level between mesial bases of right and left anterolateral spines to midpoint of posterior margin of carapace. Dorsal surface moderately convex from side to side, with relatively numerous striae as illustrated, sparsely provided with coarse setae, on anterior half in particular; cervical groove distinct, anterior bifurcation with iridescent setae at end (on lateral margin of carapace). Epigastric region with 10

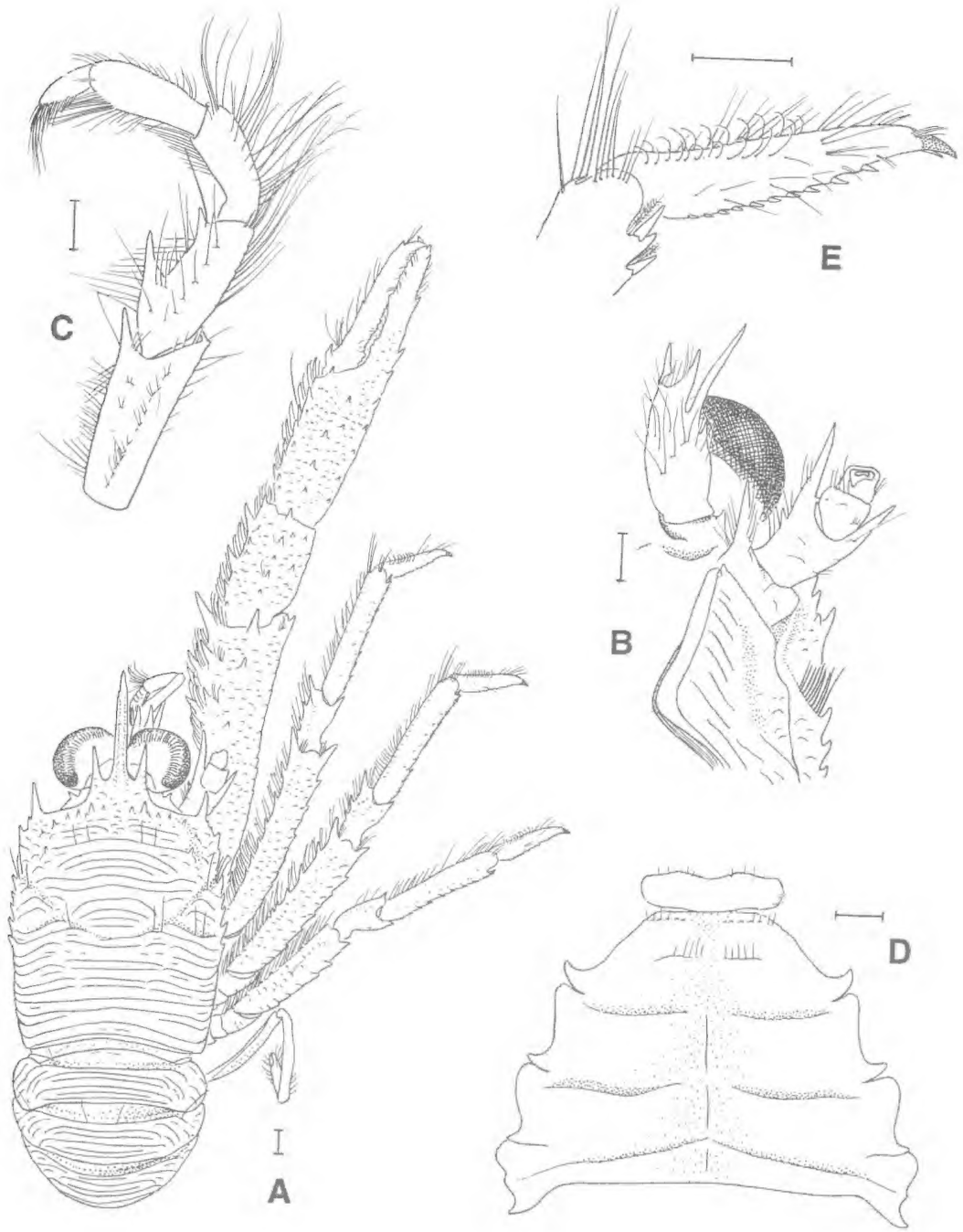

FIG. 3. *Munida alia* sp. nov., ovigerous female holotype. A, dorsal view, left appendages omitted; B, anterolateral part of cephalothorax, showing antennular and antennal peduncles, ventral view; C, endopod of left third maxilliped, lateral view; D, sternal plastron; E, distal segments of right first walking leg, lateral view. Scales = 1mm.

spines in 5 pairs, second from mesial pair situated directly behind supraocular spines, accompanying small spine at its lateral base. Lateral protogastric spine distinct, preceded by small spine slightly anterior and lateral to it. No other spinulation elsewhere on dorsal surface. Lateral margins slightly convex, anterolateral spine sharp and prominent, directed forward and somewhat laterad, barely reaching sinus between rostrum and supraocular spine, followed by a few denticular spines and 1 small spine slightly anterior to midpoint between first spine and anterior cervical groove; 5 subequal spines on anterior branchial margin behind anterior cervical groove. Front margin slightly oblique.

Rostrum spiniform, nearly horizontal but slightly upcurved distally, length 0.4 that of remaining carapace, about 3 times that of supraocular spine. Supraocular spines moderately remote from rostral spine, somewhat divergent anteriorly.

Abdominal segments strigose, second and third segments each with 6 transverse ridges, first and fourth ridges elevated, latter preceded by distinct groove or trough.

Eyes dilated, cornea 0.3 times as wide as carapace; eyestalk with fringe of short setae near cornea.

Basal segment of antennule elongate, length (exclusive of spines) 2.2 times its greatest width; 2 terminal spines subequal in size. Antennal peduncle having first segment with strong ventral distomesial spine reaching end of next segment; second segment with well-developed distomesial and distolateral spines, former distinctly overreaching end of peduncle, accompanied by small extra spine proximal to it, latter ending at midlength of ultimate peduncular segment.

Endopod of third maxilliped relatively slender. Ischium with prominent spine on flexor distal margin, unarmed on extensor margin; mesial ridge with 25 or 26 denticles. Merus with 2 flexor marginal spines, proximal one very strong, situated about 1/3 from proximal end, distal one small and terminal; no spine on extensor margin. Distal 2 segments relatively slender.

Sternal plastron as illustrated, with a few striae on fourth thoracic sternite. Third thoracic sternite laterally expanded, 4.5 times as wide as long, anterior margin sinuous, provided with fine blunt denticles. Following sternite twice as long as preceding, with relatively wide anterior margin, not triangular.

Chelipeds similar, relatively stout, length 3 times that of carapace (excluding rostrum), surface with fine squamiform ridges, and both iridescent, and fine plumose setae, particularly on mesial face. Spination as figured. Merus with another row of 4 ventromesial spines; 3 prominent mesial marginal spines, particularly distalmost. Carpus with 3 small ventromesial and 1 distoventral spines, all invisible in dorsal view. Propodus moderately depressed, somewhat narrower than merus, more than twice as long as wide, nearly equal in length to movable finger, lateral marginal spines somewhat dorsal in position, dorsal surface with median row of spines, mesial margin with row of 3 spines paralleling another row of 4 distinct and a few small spines somewhat dorsal in position. Fingers distally curving, crossing when closed, somewhat gaping in proximal half; movable finger having mesial margin with 1 well-developed proximal and 1 small subterminal spine interspersed by a few small spines; fixed finger with line of 5 lateral marginal spines continued onto propodus, distal 2 nearer to each other, distalmost subterminal.

Walking legs relatively short, with squamiform ridges on surface and both iridescent and fine plumose setae on mesial face except for dactylus with coarse setae; first walking leg reaching to midlength of cheliped propodus. Merus with row of 11 or 12 extensor marginal spines and another line of 6 or 7 flexor marginal spines on first and second walking legs, these spines diminishing in size proximally; terminal spines pronounced, flexor marginal terminal larger, proximal 4 or 5 extensor marginal spines very small and somewhat lateral in position; on third walking leg, extensor margin with 4 small spines on proximal half, flexor margin with a few spines and denticles. Carpus with 4 (on first), 3 (on second), and 1 (on third) spines on extensor margin, in addition to one at distal end of flexor margin. Propodus less than twice, but more than 1.5 times, length of dactylus, fully 6 times as long as high, flexor margin produced into spine on distal corner, with 11 movable slender spines. Dactylus ending in curved corneous spine, flexor margin convex, with 10 (on first), 9 (on second), 8 (on third) slender spines, each arising from low process, but distalmost of these present at base of corneous toe.

REMARKS

Lack of granules on the seventh thoracic sternite, subequal terminal spines on the antennular basal segment, and lack of the extensor distal marginal spine on the merus of the third maxilliped link the species to *Munida semoni*

Ortmann, 1894, *M. oritea* Macpherson & Baba, 1993 and *M. striola* Macpherson & Baba, 1993. The new species differs from the last two species in the less strigose sternal plastron and the distomesial spine of the basal antennal segment not distinctly overreaching the second antennal segment. Another close relative, *M. semoni*, is characterized by a row of spines on the second abdominal segment, and absence of the extra spine on the mesial margin of the second segment of the antennal peduncle, both the obvious differences from the new species.

Munida curvirostris Henderson, 1885

Munida curvirostris Henderson, 1885: 412.
Munida militaris var. *curvirostris* Henderson, 1888: 139, pl. 3: figs. 7, 7A, 7B.
Munida andamanica Alcock, 1894: 321.

MATERIAL EXAMINED
Sta. 51-2 (18°03.85'S, 147°19.50'E), 689-704m, sledge, 18 May 1986, 2 ♂(10.2, 12.5mm), 2 ovig. ♀(10.2, 13.4mm), 1 ♀(6.2mm), QMW19706.

REMARKS
As noted by Baba & Macpherson (1991:538), *Munida andamanica* Alcock, 1894, a well-known species in the Indo-West Pacific, should be merged with *M. curvirostris* Henderson, 1885.

RANGE
Indo-West Pacific from east African coast eastward and northward to Japan, in 141-1,360m; see Baba (1988:86) for distribution.

Munida declivis sp. nov.
(Fig. 4)

MATERIAL EXAMINED
HOLOTYPE: ♀(7.6mm), QMW19708, Sta. 42-2 (17°21.77'S, 146°48.52'E), 303-296m, sledge, 15 May 1986.
PARATYPES: Same data as holotype, 9 ♂(6.4-4.2mm), 1♀(7.4mm), 5 spec. (sex indet., 5.7-4.1mm), QMW19707; Sta. 46-3 (17°55.38'S, 147°00.96'E), 295-309m, beam trawl, 16 May 1986, 1 ♂(4.3mm), 1 spec. (sex indet., 2.7mm), QMW19709.

ETYMOLOGY
From the Latin *declivis* (sloping, inclined) referring to the very oblique front margin.

DESCRIPTION OF HOLOTYPE
Carapace elongate, 1.3 times as long as wide when measured in midline from level between mesial bases of anterolateral spines to posterior margin of carapace. Transverse ridges as figured, cervical groove distinct. Epigastric region with row of 10 spines in 5 pairs, median pair small, mesial second pair directly behind supraocular spines prominent, other pairs gradually diminishing in size laterally, lateral protogastric and postcervical spines small but distinct. Lateral margins subparallel, bearing 8 spines, anterior 3 in front of, and remaining 5 behind, cervical groove; first anterolateral, largest, somewhat mesial to level of third to eighth, second spine small, third smaller than first, placed at midpoint between anterolateral spine and anterior cervical groove, following 5 spines on anterior branchial region, subequal. No spine on posterior transverse ridge. Front margin strongly oblique.

Rostral spine 0.4 times as long as remaining carapace, slightly arched in lateral view, with small tubercles dorsally. Supraocular spines directed somewhat dorsad, subparallel to rostral spine, moderately remote from rostrum, and barely reaching its midlength.

Second abdominal segment with 3 transverse ridges, first (anterior) ridge with 8 spines, second ridge interrupted, third ridge uninterrupted, preceded by distinct groove. Third abdominal segment unarmed.

Basal segment of antennule elongate, distomesial spine distinctly shorter than distolateral, proximal lateral spine small, median lateral spine elongate, directed anterodorsad. Antennal peduncle having first segment with ventral distomesial spine sharp, moderate-sized, not reaching end of second segment; second segment with distomesial and distolateral spines both well developed, subequal in size; third segment unarmed.

Ischium of third maxilliped with well-developed spine on flexor distal margin and very small one on extensor distal margin, mesial ridge with 22 or 23 denticles. Merus relatively less setose, flexor margin with 2 spines, distal one terminal and small, proximal one prominent, slightly proximal to midlength, extensor margin unarmed.

Sternal plastron barely strigose. Third thoracic sternite short, about 5 times as wide as long; fourth thoracic sternite triangular in shape, width 2.3 times that of preceding sternite.

Chelipeds unequal; right one shorter, presumably regenerated, with somewhat

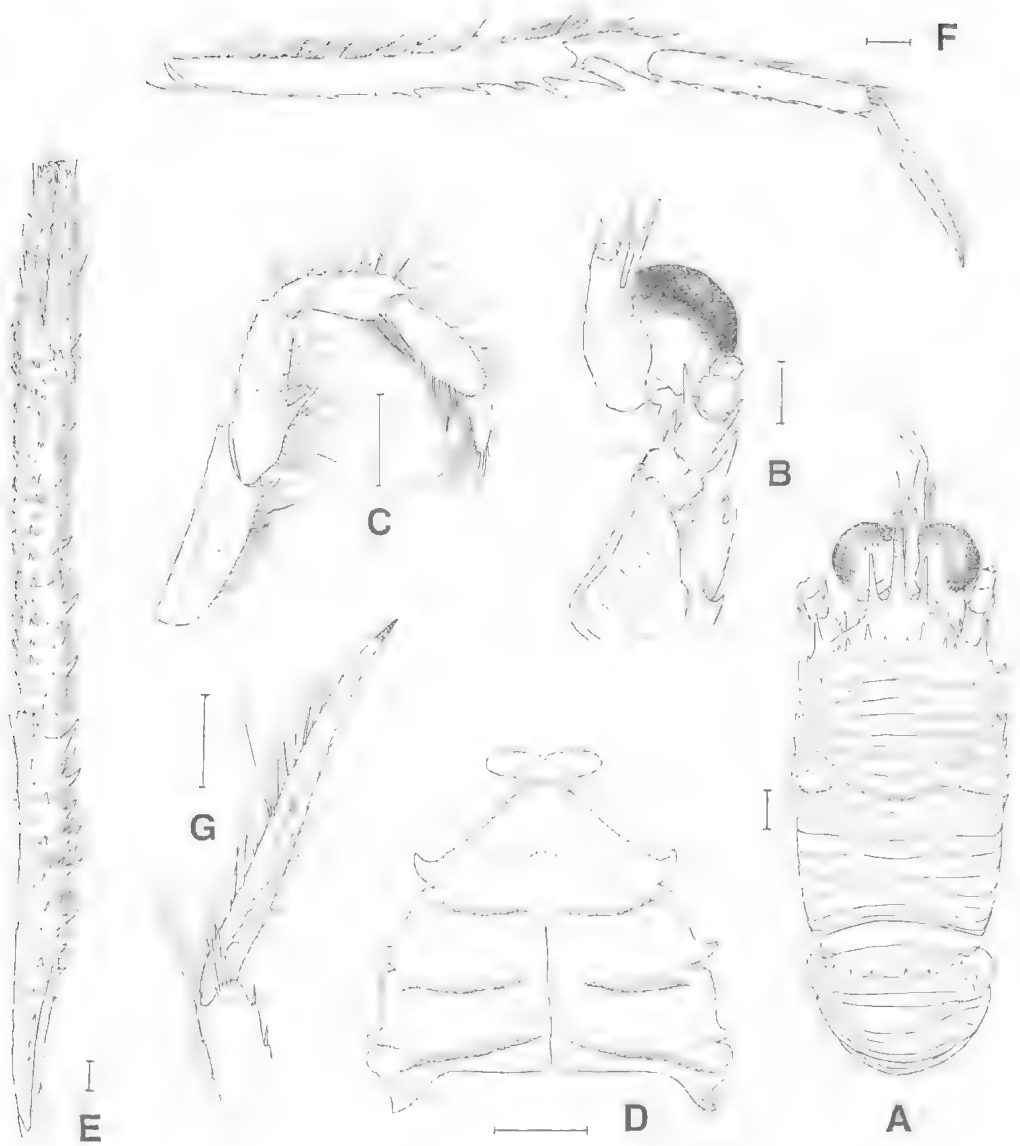

FIG. 4. *Munida declivis* sp. nov., female holotype. A, carapace and abdomen, dorsal view; B, anterolateral part of cephalothorax, showing antennular and antennal peduncles, ventral view; C, endopod of right third maxilliped, lateral view; D, sternal plastron; E, left cheliped, dorsal view; F, right first walking leg, lateral view; G, distal part of same, lateral view. Scales = 1mm.

pronounced spination. Left cheliped 4.6 times as long as postorbital carapace length, with chela somewhat depressed; laterally with fine plumose setae, mesially with both iridescent and plumose setae; ventral surface granulate; dorsally armed with 4 rows of spines on merus, carpus and propodus (2 dorsal and 1 mesial, 1 lateral); another ventral row of smaller spines near mesial margin on merus and propodus. Merus relatively long, slightly shorter than chela (propodus and fingers combined). Carpus 2.8 times as long as wide, 0.66 times as long as propodus. Propodus

4.4 times as long as wide. Fingers 0.89 times as long as propodus, slightly gaping proximally, distally ending in strongly curved, crossing claws; movable finger having mesial margin with 3 spines (proximal pronounced, distal terminal, median at 2/3 from proximal end), accompanying 1 dorsal and 1 ventral row of smaller spines, each row situated near mesial margin; fixed finger with row of lateral spines continued onto propodus.

Walking legs slender, dorsally with both fine plumose and iridescent setae. First walking leg reaching end of cheliped carpus. Merus with spines on flexor and extensor margins on first and second walking legs, distalmost of latter prominent but falling short of end of carpus, spination on third leg rather reduced. Carpi of first and second walking legs each with well-developed spine on extensor and flexor distal margins and additional smaller one about at mid-length of extensor margin, that of third walking leg with small spine on extensor distal margin. Propodus 1.2 times as long as dactyli on first walking leg, equally long on second and third, flexor margin with 10, 9, 2 or 3 slender spines on first, second and third leg respectively. Dactylus slender, slightly curving, ending in corneous tip on first 2 legs; somewhat stouter, more strongly curved, ending in strong claw on third leg; flexor margin with 4 or 5 very fine denticles each with short corneous setae, distalmost seta present at point 0.36 from distal end.

VARIATION

Supraocular spines usually subparallel, rarely somewhat convergent anteriorly, length 0.24-0.36 (average, 0.29) times that of rostral spine. Epigastric spines numbering mostly 8 (4 pairs); in younger specimens median and lateralmost pairs obsolete. Number of spines on second abdominal segment usually 8, rarely 7, 6, 5 or 4, fewest number only in younger specimens. Flexor margins of propodi of walking legs with usually 7 or 8 spines, occasionally 6, rarely 6 or 9 on first and second walking legs, 3 or 4 on third. Dactyli of first and second walking legs with 4 or 5, rarely 6 small spines, ultimate one rather distant from toe end (at least 1/4 of length), that of third walking leg with usually 4, rarely 3 very small spines, present in proximal half.

Males with 2 pairs of gonopods.

REMARKS

The strongly oblique front margin, elongate carapace, and slender walking legs, characteristic of *Munida declivis*, are also possessed by *M. kuboi* Yanagita, 1943. The new species is readily distinguished from that species by the lack of dorsal spines on the third abdominal segment and the much shorter and very spinose chelipeds.

Munida eminens Baba, 1988

Munida eminens Baba, 1988: 95, fig. 35.

MATERIAL EXAMINED

Sta. 15-4 (17°45.99'S, 148°39.09'E), 964-958m, beam trawl, 9 May 1986, 1 ♀ (12.8mm), QMW19710.

REMARKS

Munida eminens may be characterized by the following combination of characters: the carapace bearing four lateral marginal spines behind the anterior bifurcation of the cervical groove; the antennal peduncle having the first segment with an extremely long distomesial spine directed straight forward, only slightly falling short of the end of the rostral spine; the third thoracic sternite short and strongly expanded laterally; and the dactyli of the walking legs depressed, falciform and proportionately wide.

The present specimen is not intact, having no abdomen and chelipeds. Lack of the posterior cardiac spine as well as the hindmost of the three postcervical spines displayed by this specimen may be considered as variation.

RANGE

Previously known from the Philippines in Palawan Passage and off southeastern Luzon, in 564-686m. The range is now extended to eastern Australia.

Munida heteracantha Ortmann, 1892

Munida heteracantha Ortmann, 1892: 255, pl. 11: figs. 12, 12i, 12k; Macpherson & Baba, 1993: 393, fig. 6.

Munida exigua Baba, 1988: 98, fig. 36.

MATERIAL EXAMINED

Sta. 42-2 (17°21.77'S, 146°48.52'E), 303-296m, sledge, 15 May 1986, 1 ♂ (4.8mm), QMW19717.

REMARKS

The type material of *M. heteracantha* now in the collection of the Musée Zoologique, Strasbourg, has been redescribed by Macpherson & Baba (1993:393) and *M. exigua* Baba, 1988, was synonymized with this species.

The present specimen has been found in a lot from Station 42-2 in which *M. declivis* new species is included (see above).

RANGE

Previously known from the Philippines, Indonesia, off Hong Kong, and Sagami Bay, Japan, in 68-222m. Recorded from eastern Australia for the first time.

?**Munida incerta** Henderson, 1888

Munida incerta Henderson, 1888: 130, pl. 13: figs. 4, 4a; Baba, 1988: 106 (synonymy and references).

MATERIAL EXAMINED

Sta. 47-2 (17°51.76'S, 147°07.95'E), 503-497m, sledge, 16 May 1986, 2 ovig. ♀(19.6, 21.2mm), QMW19718.

REMARKS

This identification is provisional, for the specimens have a red spot on the distal portion of the propodus of the walking legs, which is at variance with the color illustration of *Munida incerta* provided by Miyake (1982: pl. 49, fig. 5) and Baba in Baba et al. (1986: fig. 121). There are no distinct morphological differences between these specimens and previous descriptions. However, available male specimens taken outside the Great Barrier Reef off Bowen, Queensland, and off Taiwan which likewise bear such red color spots, have a pronounced outward process on the anterior lateral expansion of the telson. This process is absent in specimens from the vicinity of the Kei Islands, the type locality of *M. incerta*, in the collection of the Copenhagen Museum, as well as in those reported by Miyake (1982) and Baba in Baba et al. (1986) (Baba, unpubl.). This fact suggests the existence of another species closely related to *M. incerta*. Further investigation of these differences will be reported elsewhere, but the present females are not sufficient for clarification of the problem.

Munida leviantennata Baba, 1988
(Fig. 5)

Munida leviantennata Baba, 1988:111, figs. 41, 42.

MATERIAL EXAMINED

Sta. 43-2 (17°34.58'S, 146°53.21'E), 458-500m, sledge, 15 May 1986, 1 ♂(14.5mm). QMW19719; Sta. 52-2 (18°04.16'S, 147°17.17'E), 490-512m, beam trawl, 18 May 1986, 1 ♂(12.1mm), QMW19720.

REMARKS

The supraocular spines which were broken in the unique female holotype and which were speculated to be very close to the rostrum (Baba, 1988: 111), are rather remote from it; they are more or less divergent anterolaterally and more than two-thirds the length of the rostral spine. Two pairs of gonopods are present in the male.

RANGE

Previously known only from the Molucca Sea off west coast of Halmahera, in 485m.

Munida magniantennulata Baba & Türkay, 1992

Munida magniantennulata Baba & Türkay, 1992: 205, figs. 2, 3; Baba & de Saint Laurent, 1992: 326.

MATERIAL EXAMINED

Sta. 20-4 (17°45.04'S, 147°48.14'E), 1,228-1,223m, beam trawl, 10 May 1986, 1 ♀(7.5mm), QMW19721; Sta. 35-3 (16°50.83'S, 147°10.61'E), 1,607-1,609m, sledge, 14 May 1986, 1 ♀(5.0mm): QMW19722.

REMARKS

This species has recently been described from active thermal vent areas in the Lau Basin in 1750-2003m (Baba & Türkay, 1992:205; Baba & de Saint Laurent, 1992:326). As its name suggests, this species has an unusually large antennular basal segment that, spines excluded, overreaches the midlength of the rostral spine, and exceeds the cornea by more than the full length of the eyestalk and cornea. The following characters seen in this material from non-active thermal vent areas differ from the type but may be within the limit of variation; four distinct epigastric spines, the lateral two smaller; chelipeds more spinose with relatively strong spines, the palm bearing a distinct dorsal row and the fixed fingers bearing one or two additional lateral marginal spines on the larger specimen; the second abdominal segment bears two or four dorsal spines, and the following segment bears a distinct transverse groove preceded by an elevated anterior ridge.

The larger specimen from Station 20-4 bears an externa and a few scars of rhizocephalan parasites.

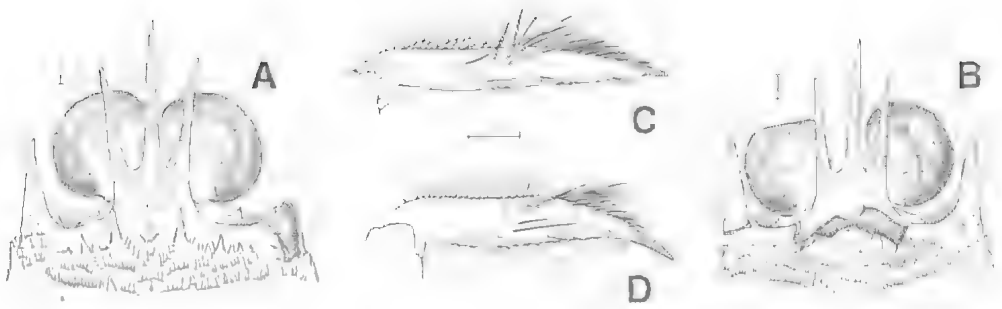

FIG. 5. *Munida leviantennata* Baba, 1988. A, C, D, male from Sta. 43-2; B, male from Sta. 52-2. A, anterior part of carapace; B, same; C, dactylus of second walking leg, lateral view; D, dactylus of third walking leg, lateral view. Scales = 1mm.

RANGE

Previously known from the Lau Basin, in 1750-2003m.

Munida microps Alcock, 1894

Munida microps Alcock, 1894: 326; Baba, 1988: 122 (references and synonymy).

MATERIAL EXAMINED

Sta. 1-3 (18°07.87'S, 147°35.7'E), 956-969m, sledge, 6 May 1986, 1 spec. (sex indet., 5.8mm), QMW19723; Sta. 14-1 (17°49.45'S, 148°39.51'E), 990-1,006m, beam trawl, 8 May 1986, 1 ♂(14.9mm), QMW19724.

REMARKS

In the larger specimen, eyes are somewhat larger than noted in earlier descriptions, but other specific characters are as diagnosed by Baba (1988:122). Two spines on the third abdominal segment are present as reported for the 'Albatross' specimen (Baba, 1988:122). The branchial spines directly behind the middle of the anterior bifurcation of the cervical groove is barely discernible in the smaller specimen.

RANGE

Previously known from the Arabian Sea, Maldives, off Colombo, Andaman Sea, Sulawesi and southeastern Australia off Green Cape, New South Wales; in 686- 1,234m.

Munida pilosimanus Baba, 1969

Munida pilosimanus Baba, 1969: 26, figs. 8, 9; Baba, in Baba et al., 1986: 173, 291, fig. 123; Baba, 1988: 123.

MATERIAL EXAMINED

Sta. 52-2 (18°04.16'S, 147°17.17'E), 490-512m, beam trawl, 18 May 1986, 1 ♂(30.2mm), QMW19725.

REMARKS

Lateral protogastric spines are absent, but this specimen is undoubtedly referred to *M. pilosimanus*. No additional characters of significance were noted.

RANGE

Previously known from the Sulu Archipelago, Kyushu-Palau Ridge, Okinawa Trough and Tosa Bay, in 250-582m.

Munida rubridigitalis sp. nov.
(Fig. 6)

MATERIAL EXAMINED

HOLOTYPE: ♂(10.6mm), QMW19726,Sta. 47-2 (17°51.76'S, 147°07.95'E), 503-497m, sledge, 16 May 1986.

PARATYPES. Same data as holotype, 2 ♂(10.0-12.7mm), 3 ovig. ♀(10.9-12.1mm), 1 ♀(9.5mm), 1 spec. (sex indet., 10.0mm), QMW19727.

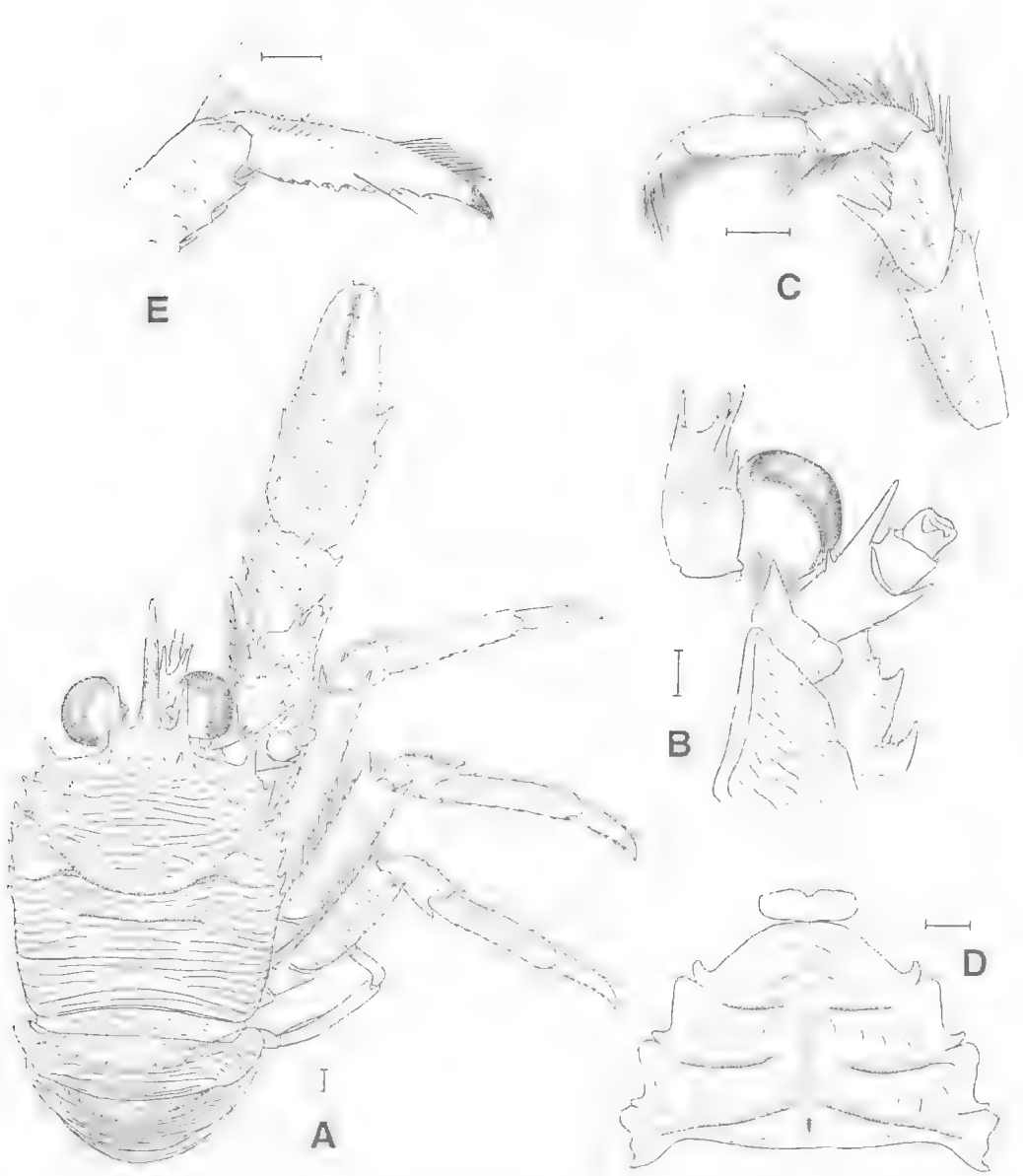

FIG. 6. *Munida rubridigitalis* sp. nov., male holotype. A, dorsal view, left appendages omitted; B, anterolateral part of cephalothorax, showing antennular and antennal peduncles, ventral view; C, endopod of left third maxilliped, lateral view; D, sternal plastron; E, distal segments of right first walking leg, lateral view. Scales = 1mm.

ETYMOLOGY

From the Latin *ruber* (red) and *digitalis* (pertaining to a finger), alluding to the reddish tips of the cheliped fingers, a character that separates the species from its close relative *M. compressa* Baba, 1988.

DESCRIPTION OF HOLOTYPE

Carapace, when measured from point level with mesial bases of left and right anterolateral spines to midpoint of posterior margin, slightly wider than long, dorsally arched from side to side, with numerous transverse ridges as figured,

median transverse ridge behind midcervical groove somewhat elevated. Cervical groove distinct. Epigastric region preceded by distinct depression, bearing row of 6 spines in 3 pairs, mesial pair small, subequal to lateral pair in size, median pair directly behind supraocular spines pronounced. No other spinulation elsewhere on carapace. Lateral margin somewhat convex medially, bearing 7 spines: 2 in front of, and 5 behind, anterior bifurcation of cervical groove; first anterolateral, largest, 2 very small denticles behind; second spine smaller than first; third to seventh subequal, placed on anterior branchial region. Front margin somewhat oblique.

Rostral spine considerably compressed laterally, relatively high dorsoventrally, upcurved to about 30°, length about half that of remaining carapace and about four-fifths distance between its base and midcervical groove. Supraocular spines relatively stout, subparallel, 0.4 times as long as rostral spine; elevated as high as rostral spine but tip somewhat depressed.

Abdominal segments with numerous striae; second segment dorsally with 7 ridges, anterior first ridge well elevated, with 8 spines of small size, fourth ridge preceded by distinct groove; third segment with 9 striae, fifth stria preceded by groove.

Eyes dilated, 0.25 times as wide as carapace excluding spines, eyestalks with fringe of short setae near cornea.

Basal segment of antennule, exclusive of spines, nearly reaching end of cornea; 2 terminal spines subequal in size. First (proximal) segment of antennal peduncle produced into short stout spine at ventral distomesial margin; second segment also produced on distomesial and distolateral margins into sharp spines (distomesial one reaching end of peduncle), with extra small spine at midpoint of mesial margin; third and fourth segments unarmed.

Third maxilliped having ischium with small spine on flexor distal margin, mesial ridge with 28 denticles. Merus distally narrowed, flexor margin with 2 spines, distal one terminal and smaller, proximal one situated at midlength of margin, prominent, accompanying very small spine distal to its base, extensor margin unarmed. Distal 2 segments slender.

Sternal plastron as figured, bearing scale-like ridges. Third thoracic sternite with bilobed anterior margin, 3.6 times as wide as long. Fourth thoracic sternite 2.3 times as long as preceding sternite, anterior margin rounded, its median portion contiguous to that of posterior margin of third thoracic sternite. Seventh thoracic sternite lacking granules.

Chelipeds similar, relatively massive, granulate on surface, marginally provided with both iridescent and short fine plumose setae somewhat thicker on mesial margins of merus. Merus with anterior end not reaching tip of rostrum, with 4 terminal spines: dorsomesial spine strong, accompanied by small spine proximal to it; dorsal spine pronounced but smaller than dorsomesial, followed proximally by 7 other dorsal spines in row near lateral margin; lateral spine smaller, subequal to ventromesial, accompanied proximally by smaller spine; another distal spine middorsally, somewhat proximal to level of terminal spines. Carpus relatively short, somewhat longer than wide, spination as figured, distal second of mesial marginal spines prominent. Propodus moderately depressed, barely 1.5 times as long as carpus, 1.4 times as long as wide, lateral margin convex with 5 spines, distal one pronounced, remaining 4 very small; mesial margin with row of 4 or 5 small spines, those on right cheliped somewhat dorsal; dorsal surface proximally with small spine somewhat lateral to midline only on left cheliped. Fingers about as long as propodus, distally strongly curving, crossing when closed, opposable margins not gaping, lined with denticles, fixed finger having lateral margin with small subterminal and another small proximal one, movable finger unarmed on mesial margin.

Walking legs relatively stout, posteriorly diminishing in size, covered with squamiform ridges particularly distinct on meri, mesially with both fine plumose and iridescent setae thick on meri, carpi and proximal half of propodi. First walking leg fully reaching juncture between propodus and movable finger of cheliped. Merus with 11 or 12 extensor marginal spines on first and second walking legs, terminal one strong; 1 strong terminal and 1 or 2 small accompanying spinules on third walking leg; flexor margin with terminal spine about as large as extensor terminal on anterior 2 legs, somewhat smaller on third. Carpus having extensor margin with strong distal spine followed proximally by smaller spine and 3-6 denticles. Propodus 6 (first walking leg), 8 (second), 7 (third) times as long as high, 1.4 (first), 1.6 (second), 1.5 (third) times as long as dactylus, flexor margin with 8 relatively short corneous spines. Dactylus distally sharpened and curved, more distinctly so on third walking leg, extensor margin with rather stiff long setae on one-third length proximal to corneous toe, flexor

margin with 8 (on first and second) or 7 (on third) low processes each with seta-like inclined short spines, unarmed on distal fourth.

Epipods absent from all pereopods.

COLOUR IN PRESERVATIVE

Reddish on distal part of rostrum and distal half of fingers of cheliped.

VARIATION

Three pairs of epigastric spines usually present, occasionally accompanied by a few small spines or tubercular processes laterally. Lateral protogastric spines present or absent. Number of spines on second abdominal tergum varying between 8 and 11 (mostly 8). Merus of cheliped with or without spine proximal to prominent terminal dorsomesial one; another spine proximal to terminal ventromesial one often absent. Number of propodal flexor marginal spines varying from 7 to 11 (mostly 9) on first walking leg, 8 or 9 on second, mostly 8, often 9, rarely 7 on third.

REMARKS

Munida rubridigitaris is most closely related to *M. compressa* Baba, 1988, a species distributed from the Molucca Sea, South China Sea from off southwestern Luzon, north to off southwestern Formosa and Tosa Bay, 180-545m (Baba, 1988:91), in particular, the compressed rostrum with a red distal mark and the short chelipeds with pronounced terminal spines on the merus. The differences between the two species are very slight, but I believe that the combination of the following characters is sufficient to differentiate them: the transverse ridges on the carapace and abdominal segments in *M. rubridigitalis* are distinctly more numerous (seven and nine ridges on the second and third abdominal segment, respectively) and rather weakly elevated, while in *M. compressa* they are fewer (in particular, the second and third abdominal segments have only 3 ridges each) and major striae on the carapace are rather elevated; the propodi of the walking legs have 5 or 6 slender spines in *M. compressa*, 8 or 9 in *M. rubridigitalis*; the cheliped fingers are reddish on the distal half in *M. rubridigitalis*, whitish over their whole length in *M. compressa*; the pterygostomian flap has a reddish patch directly below the linea anomurica in *M. compressa* (Baba, unpubl.), none in *M. rubridigitalis*.

Munida squamosa Henderson, 1885

Munida squamosa Henderson, 1885: 409; Yanagita, 1943: 18; Macpherson, 1993: 425.

MATERIAL EXAMINED

Sta. 47-2 (17°51.76'S, 147°07.95'E), 503-497m, sledge, 16 May 1986, 13 ♂(11.2-14.8mm), 11 ovig. ♀(11.3-14.7mm), 3 ♀ (9.5-9.7mm). QMW19711.

REMARKS

According to Macpherson (1993: 425), *M. squamosa* is characterized by the prominent cardiac spine, presence of a spine on the distomesial margin of the second segment of the antennal peduncle, and short and stout dactyli of the walking legs, all to mention the obvious differences from *M. analoga* Macpherson, 1993, from the Philippines and Indonesia. The 'Albatross' material of *M. squamosa* identified by Baba (1988:133) was merged with *M. analoga* (Macpherson, 1993: 424).

RANGE

Previously known from the Admiralty Islands and Japan in 275-360m. The known range is now extended to eastern Australia.

Munidopsis Whiteaves, 1874
Munidopsis cidaris sp. nov.
(Fig. 7)

MATERIAL EXAMINED

HOLOTYPE: ♂(11.6mm), QMW19712, Sta. 25-1 (17°18.73'S, 147°37.20'E), 1,128-1,178m, beam trawl, 11 May 1986.

ETYMOLOGY

The specific name is a noun in apposition from the Greek *kidaris*, referring to the name of this expedition.

DESCRIPTION OF HOLOTYPE

Carapace, excluding rostrum, slightly longer than wide, narrowed posteriorly, moderately arched transversely, greatest width between anterior branchial regions, cervical groove distinct. Gastric region lacking dorsal spines, with scale-like rugae moderately elevated; moderately inflated metagastric area of reverse triangle-shape defined by shallow groove arising from near junction of anterior and posterior bifurcations of cervical groove. Hepatic and anterior branchial regions separated by anterior cervical groove, provided dorsally with tubercles; each

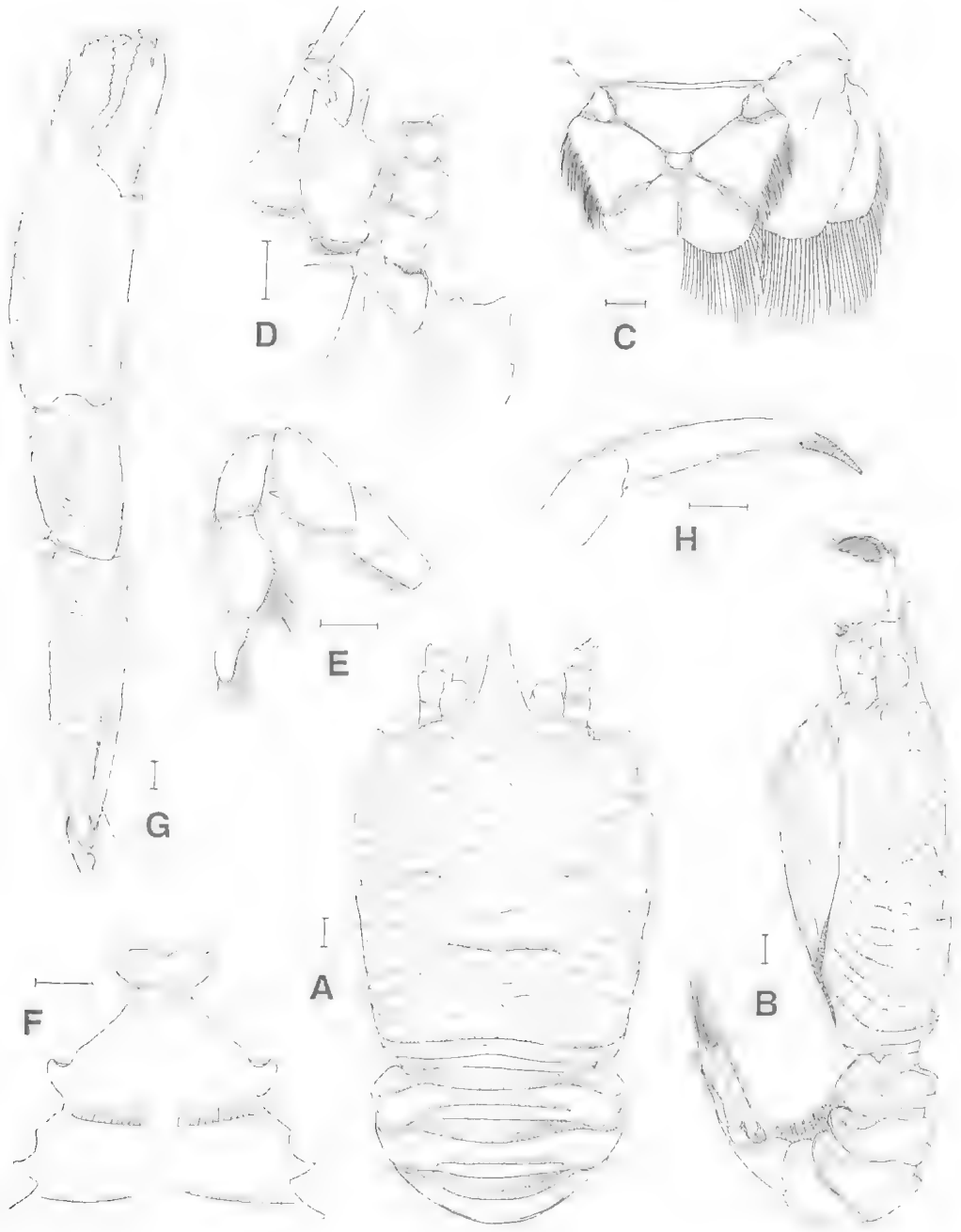

FIG. 7. *Munidopsis cidaris* sp. nov., male holotype. A, carapace and abdomen, dorsal view; B, same, lateral view; C, telson and right uropod; D, anterolateral part of cephalothorax, showing antennular and antennal peduncles, ventral view; E, endopod of left third maxilliped, lateral view; F, sternal plastron, posterior portion omitted; G, left cheliped, dorsal view; H, distal segments of right first walking leg, lateral view. Scales = 1mm.

margin lobe-like, separated by notch corresponding to cervical groove, anterior lobe (hepatic) with blunt short anterolateral spine. End of posterior bifurcation of cervical groove bordering anterior and posterior branchial regions, as figured. Posterior half of carapace with larger scale-like ridges more distinctly elevated than those on gastric region; cardiac region well elevated anteriorly but sloping down posteriorly, with transverse ridge considerably raised in profile from level directly anterior to it. Front margin slightly oblique, convex directly behind insertion of antennal peduncle.

Rostrum short, roughly triangular, basally wide, 0.27 times as long as remaining carapace; nearly horizontal, dorsally weakly carinate, ending in rounded tip.

Eyes small, immovable, reaching to about midlength of rostrum, corneas rounded; eyestalks short without any processes.

Abdominal segments rather smooth, second and third segments each with anterior and posterior transverse ridges, both well elevated; fourth segment with anterior ridge only, fifth segment without ridges, sixth segment without distinct lobes on posterior margin. Telson divided into 8 plates, midlateral plate fringed with stiff setae.

Basal segment of antennule elongate, more narrowed proximally than distally, with distodorsal spine of moderate size; lateral margin markedly inflated; distomesial portion produced but not spiniform; ventral terminal margin denticulate and strongly sloping. Antennal peduncle unarmed, first (proximal) segment with very short blunt process on ventral distomesial margin; second segment narrowed proximally.

Ischium of third maxilliped with small spine on flexor distal margin; mesial ridge with 24 denticles. Merus distinctly longer than ischium when measured in midlateral line, lateral face widest at midlength, flexor margin with 4 or 5 distally diminishing spines on distal half.

Third thoracic sternite strongly narrowed posteriorly, width slightly less than half that of following sternite, anterior margin sinuous, greatest width 3 times greatest length. Fourth thoracic sternite subtriangular, with anteriorly truncate margin contiguous to posterior margin of preceding sternite.

Chelipeds unequal in length, left one longer and wider; length 2.5 (left) or 2.1 (right) times that of carapace excluding rostrum; finely granulate, sparsely provided with short setae; somewhat depressed distally. Merus with distomesial margin bluntly produced. Carpus as long as movable finger. Propodus 1.8 times as long as wide, 1.26 (left) or 1.08 (right) times as long as movable finger; mesial margin nearly straight, lateral margin convex. Fingers slightly gaping on left, not gaping on right, ventrally spooned, opposable margins lined with denticles, medially strongly convex on fixed finger, somewhat concave on movable finger; distally incurved to cross each other when closed.

Walking legs relatively slender, finely granulate, nonspinose on surface, gradually diminishing in length; first walking leg ending at about middle of movable finger of cheliped. Merus with lateral face flattish, extensor margin crested with rounded ridge continued into carpus, flexor distal margin with minute process. Propodus about 8 times as long as wide, 1.5 times length of dactylus, flexor margin with small distal spine. Dactylus slender, strongly curving, distally spiniform, flexor margin nearly smooth, with a few very small eminences discernible under high magnification.

Epipods present on chelipeds and following two pairs of walking legs.

REMARKS

The carapace bearing scale-like, elevated tubercles, well-defined regions, weak lateral marginal spines, the second and third abdominal segments unarmed but with two elevated transverse ridges, and the chelipeds lacking distinct spines, link the species to *M. hemingi* Alcock & Anderson, 1899, obtained by the 'Investigator' from the Travancore [Kelara] coast in 787m (Alcock & Anderson, 1899:19; Alcock, 1901:251). The 'Investigator' species, however, has the carapace broader behind than in front, and bears distinct epigastric spines; the eyes are slightly movable, and have a very small papilliform spine at the mesial angle of the eyestalk; the cheliped has a distomesial spine on the carpus; and the four pairs of pereopods bear epipods. These characters all serve to separate it from *M. cidaris*.

Munidopsis rostrata (A. Milne Edwards, 1880)

Galacantha rostrata A. Milne Edwards, 1880: 52.
Galacantha rostrata: Chace, 1942: 75 (synonymy and references); Baba, 1988: 161.

MATERIAL EXAMINED
Sta. 32-2 (17°05.89'S, 147°11.85'E), 1,539-1,517m, beam trawl, 13 May 1986, 4 ovig. ♀(15.7-18.0mm), 1 ♀(13.7mm), QMW19713.

RANGE
This widespread species occurs in the Indo-Pacific, Atlantic and Southern Oceans, in 1,650-3,294m. See Chace (1942:76) and Baba (1988:162) for distribution.

Munidopsis trachynotus (Anderson, 1896)

Galacantha trachynotus Anderson, 1896: 100.
Munidopsis trachynotus: Baba, 1988: 171 (synonymy and references).

MATERIAL EXAMINED
Sta. 30-4 (17°19.12'S, 147°11.20'E), 1,403-1,385m, beam trawl, 12 May 1986, 1 ♂(25.7mm), QMW19714.

RANGE
Previously known from the Arabian Sea and Sulawesi, in 1,380-1,893m.

Munidopsis valdiviae (Doflein & Balss, 1913)

Galacantha valdiviae Doflein & Balss, 1913: 147, fig. 15, pl. 16: fig. 2.
Munidopsis valdiviae: Baba, 1982: 112, pl. 1: fig. 1; 1988: 173, fig. 71.

MATERIAL EXAMINED
Sta. 13-1 (17°58.49'S, 148°38.40'E), 1,040-1,059m, beam trawl, 8 May 1986, 1 ♂(19.6mm), QMW19715.

REMARKS
In this specimen, the two epigastric spines which are usually very small, are absent.

RANGE
Previously known from east Africa off southern Somali Republic, Molucca Sea off northwestern Sulawesi, Palawan Passage, and Japan, in 1,120-1,644m. The range is now extended to northeastern Australia.

Paramunida Baba, 1988
Paramunida scabra (Henderson, 1885)

Munida scabra Henderson, 1885: 409.
Paramunida scabra: Baba, 1988: 180 (synonymy and references); 1990:968, fig. 15A.

MATERIAL EXAMINED
Sta. 47-2 (17°51.76'S, 147°07.95'E), 503-497m, sledge, 16 May 1986, 4 ♂(8.1-9.9mm), 6 ovig. ♀(7.2-8.2mm), QMW19716.

REMARKS
The antennal peduncles are as described and illustrated for *Paramunida tricarinata* from Madagascar, not as in the female syntype of *P. scabra* (see Baba, 1990:986, fig. 15), but the gastric spination is typical of the species, having a median spine only.

RANGE
Previously known from the Malay Archipelago including the Kei Islands, northern Borneo and Philippines, off Hong Kong, off southwestern Taiwan, East China Sea, and Japan, in 70-1,630m. The range is now extended south to off northeastern Australia.

ACKNOWLEDGEMENTS

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MIDDLE DEVONIAN SCOLECODONTS FROM NORTH QUEENSLAND. *Memoirs of the Queensland Museum 35(1): 22. 1994*:-Scolecodonts were recovered from limestones of the Middle Devonian Burdekin Formation, Fanning River Group collected at Horseshoe Bend, DU 424 104; Dotswood 1:100 000 topographic sheet. Terminology follows Sylvester (1959).

Abbreviations: L-left, R-right, M-maxilla, UV- upper view, lV, lower (under) view, Most material is left in open nomenclature given its paucity and fragmentary nature.

Class POLYCHAETA
Arabellites Hinde,1879 emend Sylvester,1959
Arabellites hendersoni sp. nov. (Fig.1F,G)
Etymology. For R. A. Henderson, James Cook University.
Material. Holotype, QMF27511.
Description. Elongate LMI; prominent offset hook; dentary occupies mid 1/3 of upper side, with 5 small, closely spaced sharp denticles posteriorly inclined. Fossa 1/3 of upper side, margin broken, with thin flange. A saddle from the posterior end of the hook becomes more prominent outward-anteriorly.
Remarks. Similar to *A. conspicuous* Eller,1961 (M. Devonian, Dundee Lst., Michigan) but with only 5 denticles and dentary not extending to posterior margin. Fossa smaller and denticles fewer than *A. hamiltonensis* (Stauffer) (Sylvester,1959) from the Late Devonian-Early Carboniferous Snyder Creek and Chouteau Fmns., Missouri.

Arabellites sp. (Fig.1C)
Material. QMF27516.
Description. Small LMI or II; prominent fang, separated from 7 large, posteriorly inclined denticles. Bight strongly crescentic outer anterior margin tight.
Remarks. Lack of upper surface detail prevents assignment.

Staurocephalites Hinde,1879
Staurocephalites sp. a (Fig.1B)
Material. QMF27515.
Description. Elongate, large (0.6mm) LMII fragment; 7 sharp denticles posteriorly deflected and shortening; probable flange on long fossa.
Remarks. Fossa and sloped denticles indicate genus but species cannot be identified.

Staurocephalites sp. b (Fig.1D)
Material. QMF27514.
Description. Fragmentary, 0.9mm, LMII; 8 inclined, shortening denticles on an abraded jaw; fossa long, margin broken.
Remarks. Its fragmentary nature prevents specific assignment. It is a larger form than *Staurocephalites* sp. a.

Staurocephalites sp. c (Fig.1E)
Material. QMF27513.
Description. Large (0.9mm) elongate RMII; long fossa, stout fang; 11 moderately spaced, inclined, posteriorly shortening denticles; first large, third slightly more inclined.
Remarks. Denticle inclination and the long fossa indicate the genus, but it is not specifically identifiable.

Ildraites Eller,1936
Ildraites sp. (Fig.1A)
Material. QMF27512.
Description. Large, RMII c.1.0mm long, 0.55mm wide at midpoint. Inner margin near straight; outer anterior margin moderately convex; bight large, crescentic; fossa large with thin flange. Fang stout, slightly larger than denticles, which are well-spaced, inclined and evenly sized up to denticle 6 then becoming smaller posteriorly.
Remarks. Close to *I. bowenensis* Eller,1941 but a smaller gap between fang and denticle 1, inner margin not curved; outer margin straight.

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Sylvester, R. K. 1959. Scolecodonts from central Missouri. Journal of Paleontology 33: 33-49.

Alex G. Cook & Susan Turner, Queensland Museum, P.O. Box 3300, South Brisbane, Queensland 4101, Australia; 1 December 1993.

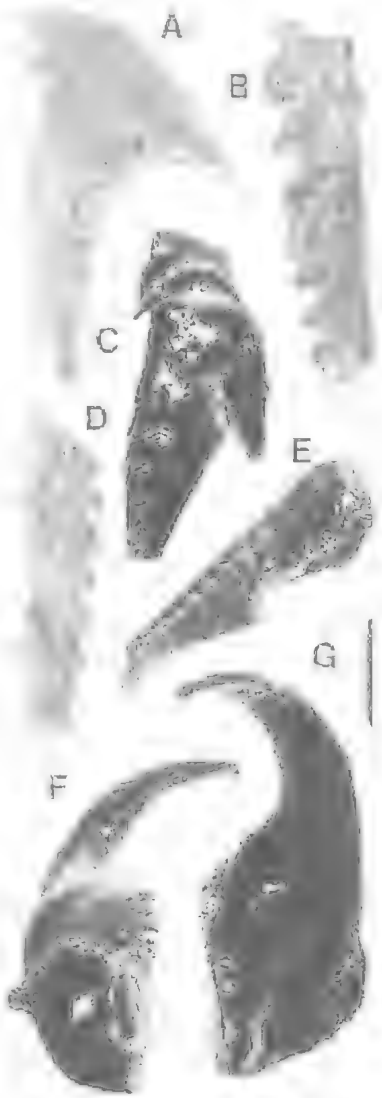

FIG. 1. A, *Ildraites* sp., UV; B, *Staurocephalites* sp. a, lV; C, *Arabellites* sp., LMI or II, oblique view; D, *Staurocephalites* sp. b, UV; E, *Staurocephalites* sp. c, UV (oblique); F,G, *Arabellites hendersoni* sp. nov. F,UV(oblique); G, lV. Scale: A-C = 200μm; D,E = 320μm; F,G = 400μm.

A NON-DESTRUCTIVE TECHNIQUE FOR DETERMINING THE SHAPES *IN SITU* OF PERMINERALIZED SEEDS

H.T. CLIFFORD AND L.G. CARNEY

Clifford, H.T. & Carney, L.G. 1994 06 01: A non-destructive technique for determining the shapes *in situ* of permineralized seeds. *Memoirs of the Queensland Museum* **35**(1):23-25. Brisbane. ISSN 0079-8835.

The usefulness of ultrasonography for determining the shapes of embedded permineralized seeds is demonstrated. □*Permineralized seeds, ultrasonics.*

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Outlines of probable peltasperm seeds whose testas are intact but whose contents have been replaced by chalcedony are sometimes exposed on the cut surfaces of 'forest floor', a silicified Mesozoic peat-like material occurring as small boulders scattered on the soil surface or in creek beds in the Miles-Chinchilla-Wandoan region of SE Queensland. As the seeds are rare a non-destructive means of determining their shape was sought. An ultrasonic technique used in optometry to explore the axial dimensions of the eye and the distance between ocular tissues, was employed to determine whether the embedded testa would provide a sufficiently distinct boundary surface for detection by sound waves.

MATERIAL AND METHODS

A slab of 'forest floor' with seed outlines exposed on its surface (Fig.1) was mounted on a horizontal stage above which was an ultrasonic probe. When the probe is placed in contact with each seed, sound waves penetrate the medium and are returned from acoustically reflective boundaries. The elapsed reflection time allows distance within the medium to be established. Velocity of the sound waves in chalcedony was assumed to be similar to that in crystalline quartz, namely, 5720m/s (Kaye & Laby,1973). In other applications, this technique has been shown to be accurate to ±0.15mm (Rudnicka et al.,1992). For selected seeds, ultrasonography was performed at 0.5mm intervals along traverses 0.1mm apart, and disposed at right angles to the long axis of the seed outline. The data were logged and transformed into images imposed on a three dimensional 1mm grid using the Microsoft Excel graphics software. To check the reliability of the technique a section was made through one of the seeds at right angles both to the

FIG. 1. Transverse section of a cluster of permineralized seeds exposed on the cut surface of QMF31911, x5.

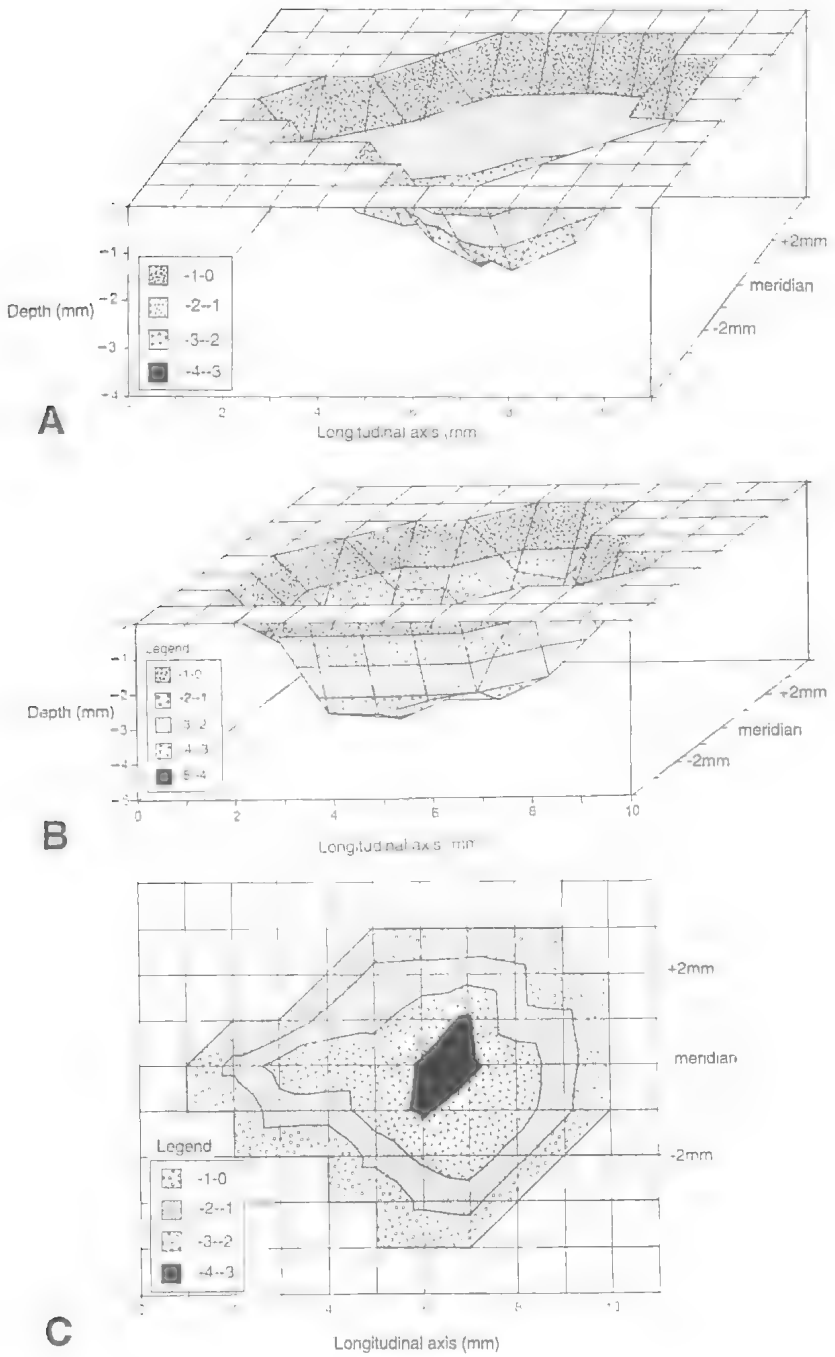

FIG. 2. Three dimensional ultrasonographs of a partial seed whose outline is exposed on the surface of a slab cut from a boulder of permineralized "forest floor". A,B, oblique-lateral views ; C, surface view.

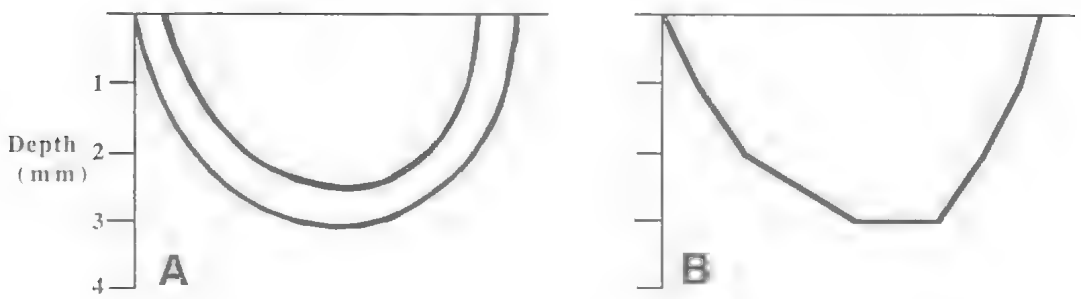

FIG. 3. Shape of the partial seed of Fig. 2 as seen in transverse section 7, to the right along the longitudinal axis. A, outline of testa on surface; B, outline of seed as indicated by the position of the acoustic reflecting boundaries as given in Fig. 2C.

plane of its exposed surface and its longitudinal axis. The shape of the embedded portion of the seed was thereby revealed.

RESULTS

Three views of a partial seed determined by this method (Fig.2) may be compared with the real shape by comparing individual traverses (Fig. 3).

DISCUSSIONS

Close correspondence between the predicted and observed shape of the embedded seed investigated confirms the capacity of ultrasonography to distinguish boundaries between fossil seeds and the matrix in which they are embedded. The technique merits further investigation to determine whether ultrasonography is applicable to the study of other permineralized fossils.

ACKNOWLEDGEMENTS

We acknowledge with pleasure the technical assistance of Chris Beck for making the measurements, the Department of Earth Sciences, University of Queensland for sectioning the seed, Natalie Camilleri for redrawing the diagrams and the Queensland Museum Photography Section for the photograph. The specimen was provided by Graham Dawes of Miles.

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DESIGNATION OF THE TYPE SPECIES OF *SALTUARIUS*, AND OTHER DATA ON THE GENUS. *Memoirs of the Queensland Museum 35(1): 26. 1994* :- The large leaf-tailed geckos of eastern Australia's rainforests originally assigned to *Phyllurus*, have been transferred to *Saltuarius* (Couper et al., 1993). *Saltuarius* now includes *S. cornutus* (Ogilby, 1892), *S. salebrosus* (Covacevich, 1975), *S. swaini* (Wells & Wellington, 1985) and *S. occultus* Couper, Covacevich & Moritz, 1993. In our detailed description and diagnosis of *Saltuarius*, we omitted to designate a type species. *Saltuarius cornutus* (Ogilby, 1892) is here designated as the type species of this genus.

When our review and elaboration of the description of *S. swaini* were completed, three Australian Museum specimens (R92122, R98333, R110510) stood apart from our sample because of what appeared to be anomalous colour patterns. Recent advice (G. Shea, in litt., 16 March, 1994) has enabled us to correct collection data for two of these specimens, and confirm that of the third. The colour and pattern of this specimen (R92122 from a eucalypt-granite locality) are those of forms more frequently associated with rainforest.

Table 1 summarizes supposed and actual collection localities and our colour and pattern descriptions of *S. swaini* from 'rainforest' and 'eucalypt-granite' localities in northern New South Wales and southern Queensland. From these data, we conclude that what we described (Couper et al., 1993) as the 'eucalypt-granite' colour form of *S. swaini* is confined to the Stanthorpe-New England Plateau area, and does not occur in rainforest.

Acknowledgements

Dr H.G. Cogger of the Australian Museum drew our attention to our omitting to designate a type species for *Saltuarius*. Dr G. Ingram of the Queensland Museum commented on this note constructively. We are grateful for their advice.

Literature Cited

Couper, P.J., Covacevich, J.A. & Moritz, C. 1993. A review of the leaf-tailed geckos endemic to eastern Australia: a new genus, four new species, and other new data. Memoirs of the Queensland Museum 34: 95-124.

P.J. Couper, J.A. Covacevich, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; C. Moritz, Zoology Department, University of Queensland, Queensland 4072, Australia; 26 February 1994.

TABLE 1. Register entries vs actual collection localities for three *S. swaini* specimens, with their colour forms.

Australian Museum reg. no.	AM register entry: Couper et al., 1993	Actual collection locality	Colour and pattern (Couper et al., 1993)	Colour form (Couper et al., 1993)
R92122	6km NW Amiens, SEQ (eucalypt-granite)	6km NW Amiens, SEQ	'gray-mid dark brown'	'rainforest'
R98333	1.5km NW Amiens, SEQ (eucalypt-granite)	Mt Warning, NENSW (rainforest)	'lichen-like'	'rainforest'
R110510	Mt Warning, NENSW (rainforest)	1.5km NW Amiens, SEQ (eucaltypt-granite)	'heavily-blotched'	'eucalypt-granite'

*The 'gray-mid dark brown' colour form is uncommon in 'eucalypt-granite' areas, but is one of two dominant colour morphs in rainforests.

A SEPTATE GASTROPOD FROM THE SILURIAN BUNGONIA LIMESTONE, NEW SOUTH WALES

ALEX G. COOK

Cook, A.G. 1994 06 01: A septate gastropod from the Silurian Bungonia Limestone, New South Wales. *Memoirs of the Queensland Museum* 35(1): 27-30. Brisbane. ISSN 0079-8835.

Michelia bauerae sp. nov., is a high-spired, extensively septate gastropod from the Late Silurian, lower Bungonia Limestone, Bungonia Caves, New South Wales. Extensive septation is confirmed within the Murchisoniidae. Septation is related to reduction in body volume, and avoidance of detrimental effects from apical breakage. *Michelia, Gastropoda, Murchisoniidae, septa, Silurian, Bungonia.*

Alex G. Cook, Queensland Museum, P.O. Box 3300, South Brisbane, Queensland 4101, Australia; 1 December 1993.

Septation is rare in high-spired gastropods but is more common in low-spired and discoidal forms particularly of the Euomphaloidea. Nine specimens of *Michelia bauerae* sp. nov. from the Bungonia Limestone confirm septation in the Murchisoniidae.

The Bungonia Limestone crops out 150km SW of Sydney, where it forms the basal Siluro-Devonian assemblage of the Wollondilly Tract in the Bungonia area. Carr et al. (1980) divided the Bungonia Limestone into upper, middle and lower limestone units separated by upper and lower shale members. Bauer (1993) reinterpreted the stratigraphy and provided a more detailed facies analysis.

Gastropods, bivalves and stromatoporoids were recovered from Flying Fortress Cave, part of the Bungonia Caves system; locality B17 of Bauer (1993) in lower limestone unit of Carr et al. (1980). The faunule occurs in shallow water, moderate to high energy, subtidal deposits (Carr et al.,1980; Bauer,1993) of late Ludlovian age (Carr, Jones & Wright,1980; Carr et al.,1980; Jones et al.,1981). I have herein used whorl profile to mean the cross sectional shape of the whorl (sensu Rohr,1980).

All material is lodged with the Queensland Museum (QMF).

SYSTEMATIC PALAEONTOLOGY

Phylum MOLLUSCA

Class GASTROPODA Cuvier,1797

Superfamily MURCHISONIOIDEA Koken,1897

Family MURCHISONIIDAE Koken,1897

Michelia Roemer,1854

Michelia Roemer, 1854: 73 (not sighted); Knight,1937. 710; Knight,1941: 194; Knight et al.,1960: 1292; Tassell,1976: 14.

Vetotuba Etheridge Jr., 1890: 62.

TYPE SPECIES

Michelia cylindrica Roemer, from the Middle Devonian of Germany; by subsequent designation of Knight (1937:710).

DIAGNOSIS

Large, high-spired, many-whorled, narrowly phaneromphalus gastropod with deep V-shaped sinus in outer lip. Whorl surface gently arched between shallow sutures, nearly flat (Knight,1941).

REMARKS

Knight et al. (1960) synonymised *Coelocaulus* Oehlert,1887 with its synonyms *Vetotuba* Etheridge Jr., and *Coelidium* Clarke & Ruedemann,1903 (Knight,1941,1944) with *Michelia*, Roemer,1854. Knight et al. (1960) questionably synonymised *Melissosia* Clarke. Tassell (1976) accepted these synonymies and assigned the type species of *Vetotuba* to *Michelia*. Rohr (1980) differed with Knight et al. (1960) separating *Coelocaulus* on views expressed by Ulrich & Scofield (1897). If Rohr's (1980) view is maintained, and Knight's (1944) opinion also accepted then *Vetotuba* cannot be placed within *Michelia*. Knight (1941: pl. 453), however, stated that Oehlert's (1887) figures overemphasise the boundaries of the selenizone, and that topotype material he illustrates shows only a weak selenizone. Type and topotype material of *Coelocaulus* (Knight,1941) does not demonstrate

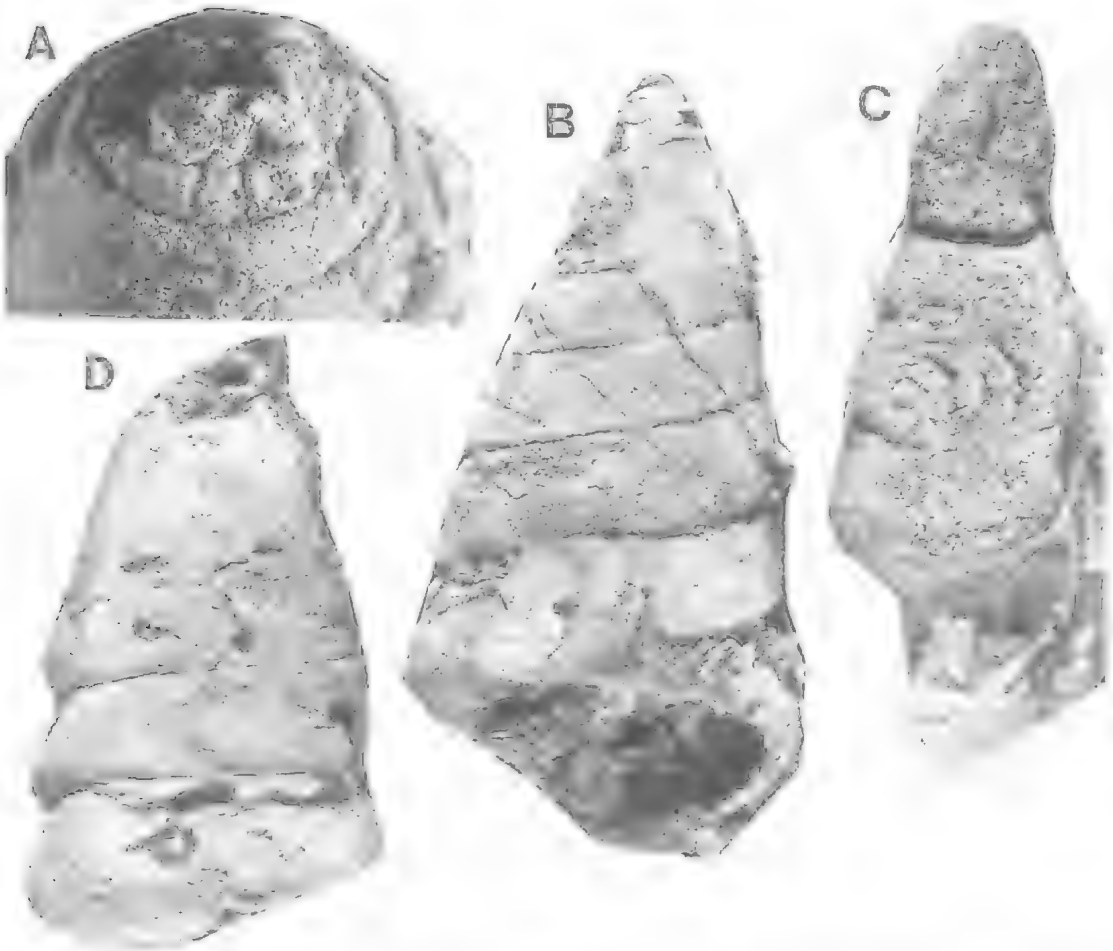

FIG. 1. *Michelia bauerae* sp. nov. A, paratype, QMF25726, apical whorls, x3; B, holotype, QMF25723, x1; C, paratype, QMF25747, worn, abraded, showing prominent septa, x1; D, paratype, QMF25722, side view, x1.

the flattened base typical of *Michelia* and *Vetotuba*. Thus I maintain synonymy of *Vetotuba* with *Michelia* and separate *Coelocaulus* from *Michelia* on the basis of basal profile.

Michelia bauerae sp. nov.
(Fig. 1)

DIAGNOSIS

Very large, cyrtoconoid, narrowly phaneromphalous gastropod with flattened whorl surface between slightly impressed sutures.

MATERIAL EXAMINED

HOLOTYPE: QMF25723.

PARATYPES: QMF25722,25724–25727,25747,29314.

AGE AND OCCURRENCE

Late Silurian (Ludlovian), Flying Fortress Cave, Bungonia Caves, Bungonia, New South Wales; lower Bungonia Limestone.

DESCRIPTION

High-spired, slightly cyrtoconoid shell, very large, up to 100mm (Table 1), width up to 52mm. Narrowly phaneromphalus with rounded, flattened base. Apical angle c.40°, apices missing from all specimens. Whorl surface flattened between slightly impressed sutures; sutural slope approximately 15°. Subovate to rounded rectangular whorl profile. Growth lines known only from QMF29314, upon which 3 poorly preserved fine collabral lines are inclined opposedly on whorl surfaces strongly suggesting angular, V-

TABLE 1. Shell parameters for material of *M. bauerae* sp. nov.

	H	W	A	M	No.	S
QMF25722	76	51	43	2		
QMF25723	100	52	42	1	4	2.7,4.2,2.3
QMF25723					5	3,4
QMF25724	51	32	*	2	6	1.0,0.5,0.5,0.5,0.5,*
QMF25726	71	39	41	1	4	2.7,2.5,4.2
QMF25727	97	33	36	3	7	5.5,4.6

H = shell height (mm); W = maximum width (mm); A = apical angle (°); M = missing whorls (estimated); No. = whorl number; S = septal spacings (mm).* = disrupted.

shaped sinus. First 4–7 whorls extensively partitioned with thin, moderately arcuate, variably-spaced septa (Table 1).

Remarks

The cyrtoconoid form, narrow persistent umbilicus and sinus allies the species to *Michelia* Roemer. *M. bauerae* has a flatter whorl surface than the type species (Knight,1941: pl.42, fig.1) and it is much larger. *M. brazeri* (Etheridge Jr.) has similar whorl surfaces, but the Bungonia species is approximately twice the size, and does not express the obvious pseudoselenizone. *M. darwini* (de Koninck) is a smaller form. De Koninck's (1876) type has an obvious flattened profile, and narrow umbilicus and a more equidimensional whorl profile (Tassell,1976,1982) compared to the horizontally elongate aperture of *M. bauerae*.

Etymology

For Julie Anne Bauer who collected and donated the material.

Septation

According to Yochelson (1971) extensive septation is restricted to the Euomphalidae, but extensive septation is now known within Omphalocirridae (Linsley, 1978), Loxonematidae, Pleurotomarioidea (Yochelson;1971, pers. comm.) and Murchisoniidae (herein). It has been noted (Cook,1993) that septation is most common within discoidal, discoidal open-coiled, and low nondiscoidal forms. *Micromphalus turris* Knight,1945 and *Fletcherviewia septata* Cook, 1993 are high-spired exceptions and *Straparollus (Euomphalus) hoffmani* Linsley & Yochelson, 1973 is a medium-spired form.

Varying opinions of septa are that they 1, add strength to the shell (Yochelson,1971); 2, eliminate the need to maintain elongate body mass (Yochelson,1971; Linsley & Yochelson, 1973; Cook,1993); and 3, allow for abandonment of early whorls and early whorl breakage without detriment (Morris & Cleevely,1981; Cook,1993). Yochelson(1971) suggested that septation related to the need for sessile forms to redistribute calcium carbonate.

Extensive septation is present within the first 4–7 whorls of this taxon. Spacing of septation within *M. bauerae* is variable according to whorl position, and within each whorl (Table 1); earlier whorls commonly show more widely spaced septa, but in later whorls septa are closer together. These limited data show that partitioning did not result in incremental body volume or body length change at a constant rate. Irregular spacing of partitions within septate gastropods has been noted (Yochelson,1971).

The primary role of septa in *M. bauerae* is perceived to be body shortening, albeit spasmodic, and avoidance of detrimental effects of apical breakage. The thin septa relative to the thick shell suggest little need for strengthening and no advantage through increased weight in the upper shell.

Shell growth in gastropods is episodic (Linsley & Javidpour,1980), and this may be reflected in septal spacing with uneven spacing showing changes in the ability to secrete shell, a response to vitality fluctuations. Given the high energy environment interpreted for the taxon's occurrence, changes in vitality could be expected. This suggests external control, related to seasonal or other fitness fluctuations given that shell secretion costs considerable energy (Wilbur & Saleuddin,1983).

Linsley & Javidpour (1980) speculated that build-up of calcium salts within the mantle prior to episodes of growth, necessitates rapid secretion of large sheets of carbonate. During periods less conducive to shell formation, calcium salt build-ups within the mantle, acquired through active ion uptake (Linsley & Javidpour,1980), could have subordinately been reduced by secretion of thin septa allowing body shortening and calcium salt reduction without extensive fitness loss.

ACKNOWLEDGEMENTS

Peter Jell, Mary Wade, Ralph Molnar and John Stanisic are thanked for discussions and en-

couragement. Julie Bauer and Tony Wright are thanked for provision of material, information on unpublished work in the area and bringing the material to my attention. Thanks go to QM library and photography sections.

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CARLIA PARRHASIUS, A NEW QUEENSLAND SKINK

P.J. COUPER, J.A. COVACEVICH AND P.J. LETHBRIDGE

Couper, P.J., Covacevich, J.A. & Lethbridge, P.J. 1994 06 01: *Carlia parrhasius*, a new Queensland skink. *Memoirs of the Queensland Museum* 35(1): 31-33. Brisbane. ISSN 0079-8835.

Carlia parrhasius sp.nov. is described from the Glennie Tableland, an isolated sandstone block on NE Cape York Peninsula, it is distinguished from its congeners by bold brown/black and white body stripes, combined with a fire-red tail. □ *Scincidae, Carlia parrhasius, Cape York Peninsula, sandstone, Morethia.*

P.J. Couper & J.A. Covacevich, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; P.J. Lethbridge, Department of Environment and Heritage, PO Box 2066, Cairns, Queensland 4870, Australia; 15 December 1993.

Skinks of the genus *Carlia* are well known in Australia, especially in the NE, where they are conspicuous for their large populations and high species diversity. Twenty-one species are recognised (Ingram & Covacevich,1989). Colour and pattern are important in distinguishing the species, because there is considerable overlap in many scale characters. Most known *Carlia* spp. are some shade of brown and have an array of distinct spots, dashes or stripes by which most can be distinguished readily. Male breeding colours are sometimes especially distinct (Ingram & Covacevich,1980,1989). Our new four fingered *Carlia* may be distinguished in form and size from other Australian genera of four-fingered skinks, except *Lygisaurus*. It is excluded from *Lygisaurus* by its high supradigital scale count on the fourth toe (>10). All *Lygisaurus* species have <10 supradigital scales on the fourth toe. The colour and pattern of the new skink are both boldly distinct amongst *Carlia*, and highly convergent with five- fingered *Morethia*, which has a fused lower eyelid (vs the moveable eyelid in *Carlia*). The new species has a brown/black and white striped body with a fire-red tail. Field and first-level laboratory examinations suggested assignment to *Morethia*.

Abbreviations used are: Queensland Museum QM; far northeastern Queensland, FNEQ; snout-vent length, SVL.

SYSTEMATICS

Carlia parrhasius sp. nov.
(Figs 1,2)

MATERIAL EXAMINED

HOLOTYPE: QMJ57868, Azure Creek, at 140±20m, Glennie Tableland, Cape York Peninsula, 12° 21.96'S, 142° 56.71'E, ±250m, FNEQ, P.J. Lethbridge & J.W. Winter, 25 Apr 1993.

PARATYPES: QMJ57867, QMJ57869, 24 Apr 1993. Other collection details as for holotype.

DIAGNOSIS

Body black and white striped with fire-red tail is a unique colour pattern in *Carlia*. Dorsal scales with weak carinations made up of a series of points, and long, acute ear lobules are shared with 2 (of 3) species restricted to rock habitats (*C. rimula, C. scirtetis*) which also have distinct colour patterns (Ingram & Covacevich,1989), but bear no resemblance to *C. parrhasius*.

DESCRIPTION

Holotype. SVL 27.4mm. Lengths (% SVL). Tail 77.0% (damaged), forelimb 30.6%, hindlimb 40.7%, head length 23.5%, head width 14.9%, axilla-groin 46.1%.

Prefrontals large, moderately spaced. Frontal elongate, 1.4 times as long as wide. Internasal and frontal scales in contact. Frontoparietals fused forming a single shield. Interparietal free. Parietal scales in broad contact behind the interparietal. Enlarged nuchal scales 2. Nuchal scales in contact with the posterior edge of the parietals 4. Supralabials 7, fifth largest and below eye. Infralabials 6–7. Presuboculars 2. Loreals 2, Supraoculars 4, first two in contact with frontal. Supra ciliaries 7. Lower eyelid movable. Transparent palpebral disc occupying more than half the lower eyelid. One primary temporal. Secondary temporals 2, upper largest and overlapping lower. Ear aperture round, much smaller than palpebral disc and surrounded by long acute lobules. Postmental in contact with first 2 infralabials. Midbody scale rows 28. Paravertebrals 49.

Mid-dorsal scales with smoothly curved

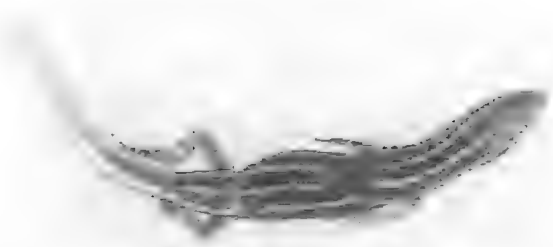

FIG. 1. Holotype of *Carlia parrhasius* sp. nov., QMJ57868 (G. Cranitch).

posterior edges; dorsal and lateral scales with weak carinations, broken up into a series of smaller points. Digits on forelimb 4. Digits on hindlimb 5. Subdigital lamellae (fourth toe) 27, smooth. Plantar scales rounded. Supradigital scales (fourth toe) 12.

Brown/black ground colour broken by silvery-white longitudinal stripes (midlateral, dorsolateral and vertebral). The midlateral and dorsolateral stripes run from the sides of the head to the base of the tail, broadening posteriorly to the hindlimbs. The vertebral stripe is shorter, beginning on the nape and running slightly beyond the hindlimbs. Head coppery-brown. Limbs mid-brown, speckled with white. Tail unpatterned along most of its length, and flushed with red. Venter, silvery-white.

Paratypes. SVL 26.2–33.5mm. Lengths (% SVL). Tail 149.6% (regenerated)–195.8% (original), forelimb 29.7–30.8%, hindlimb 39.1–40.9%, head length 21.7–24.4%, head width 14.0–16.2%. Prefrontals large, moderately to widely spaced. Internasal and frontal scales in moderate to broad contact. Supralabials 6–7, usually 7. Infralabials 6. Midbody scale rows 27–28. Subdigital lamellae (fourth toe) 26–27. Supradigital scales (fourth toe) 11. QMJ57867 similar to holotype in pattern and colour. QMJ57869 has a mid-brown ground colour and less clearly defined stripes and a midlateral stripe which is only just discernible. Its tail is mid-brown, lacking any red.

HABITAT

The Glennie Tableland is a sandstone plateau (Fig. 3) of the Mesozoic Gilbert River Formation (Willmott & Powell,1977), 60km NW of the Lockhart Aboriginal Community. The plateau is c.20km N-S and 10km at its widest point. The main escarpment faces east, rising from the coastal plain to nearly 300m, with a less pronounced escarpment on the western side, where the

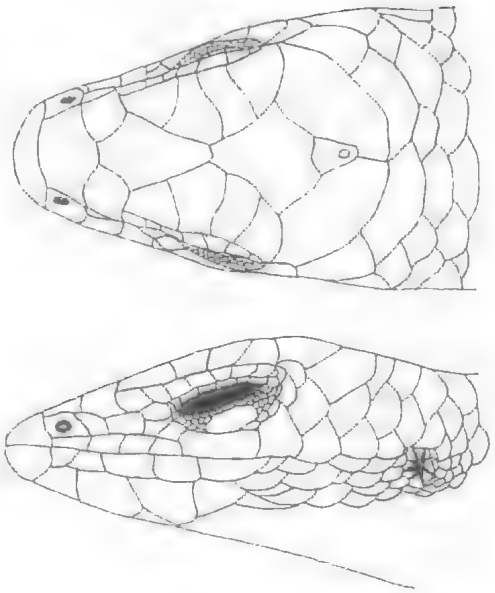

FIG. 2. *Carlia parrhasius* sp. nov., QMJ57869. Dorsal and lateral views of head.

tableland falls to the inland rolling downs at about 140m. Deeply incised valleys radiate out from the plateau and drainage is mainly into the Olive River. Sandstone cliffs, usually in a 2–3 terraces, with cliffs upto 15m in height, line the incised valleys, particularly along the N and E sides of the plateau. The predominant vegetation is grassy eucalypt woodland, with numerous patches (the largest of about 50ha) of mesophyll vine forest at the heads of the deeply incised valleys. Small patches of windswept low heath occur on the summit. The plateau is the best developed sandstone cliff habitat north of the 'Quinkan Country' in the Laura district.

C. parrhasius was collected on large sandstone fragments at the base of the cliffs and the talus slope below them. Vegetation was grassy eucalypt woodland, canopy height c.15m, with dominant trees including Darwin Stringybark (*Eucalyptus tetradonta*), a bloodwood (*E.* cf. *hylandii*) and Cooktown Ironwood (*Erythrophleum chlorostachys*). The understorey contained scattered Bushman's Clothes Peg (*Grevillea glauca*) and an Acacia (*Acacia* cf. *crassicarpa*). Ground cover was of medium- dense grass, up to 1.5m tall, on rocky ground.

ETYMOLOGY

For the Greek artist, Parrhasius, a master of deception through his work.

FIG. 3. Habitat of *Carlia parrhasius*, Glennie Tableland, Cape York Peninsula (J. Winter).

REMARKS

The holotype and paratype ♀ (QMJ57867) share the same bold colour and pattern; the larger paratype ♂ (QMJ57869) is basically brown (vs black), possibly due to age or preservation. We suggest from these meagre data, that the pattern in *C. parrhasius* may be a juvenile character.

Black and white striped bodies and red tails are seen in *Ctenotus* spp. (*C. decaneurus*, *C. leae*, *C. striaticeps*, some *C. taeniolatus*); *M. ruficauda*, *M. storri*; and some *Proablepharus kinghorni*. One striking foreign example is *Lygosoma punctata*, from Sri Lanka (da Silva, pers.comm). Red tails have been observed in the males of several *Carlia* spp. during the breeding season and in some species of *Lygisaurus*.

ACKNOWLEDGEMENTS

The Glennie Tableland was selected for survey in the Cape York Peninsula Land Use Strategy by John Winter, who was also co-collector of the type specimens. Mr Fred Sebulla allowed the survey team access to the Glennie Tableland. Gary Cranitch and Bruce Cowell prepared the photographs. Keith McDonald and Glen Ingram provided helpful comments on the manuscript.

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THE HOLOTYPE OF *MOCOA SPECTABILIS* DE VIS, 1888. *Memoirs of the Queensland Museum 35(1): 34. 1994*:- In a review of the skinks of the *Saproscincus challengeri* complex in southeastern Australia, Sadlier et al. (1993) claimed that *Mocoa spectabilis* de Vis, 1888 was a senior synonym of *Lampropholis basiliscus* Ingram & Rawlinson, 1981, and thus the available name for the taxon. This was based on their identification of the 'lectotype' of *Mocoa spectabilis* (Queensland Museum specimen QMJ19743), which was declared by Wells & Wellington (1985). Sadlier et al. (1993) also identified the 'paralectotypes' as follows: QMJ255 and QMJ19742 = *Saproscincus basiliscus*, QMJ244 = *S. galli* Wells & Wellington, 1985. I do not disagree with the identifications of Sadlier et al. (1993). However, I disagree that QMJ255 and QMJ19742-3 were part of a type series for *Mocoa spectabilis*: I assert there was only a holotype, QMJ244.

Firstly, de Vis's (1888: 819-820) description of *Mocoa spectabilis* was only of one specimen: multiple specimens were not mentioned. That is, there was a holotype, not syntypes. Secondly, as Covacevich (1971) noted, the measurements of QMJ244 fit those in de Vis's description. For example, de Vis's measurements and scale counts were as follows (with mine in brackets): pair of nuchals (pair), 7 supraciliaries (7), 22 midbody rows (22), fourth toe lamellae 20-24 (22-26), total length 134mm (134), head length 10.5 (10), body 42 (41), fore limb 10.5 (12), hind limb 18 (18) and tail 81.5 (83). This is nearly an exact fit and their is little doubt that this was the specimen de Vis (1888) had, and thus his holotype. Finally, QMJ244 is also listed as 'Type' in the Queensland Museum's register.

Wells & Wellington (1985) and Sadlier et al. (1993) did not say why they accepted syntypes for *Mocoa spectabilis*. However, I assume they — and Cogger et al. (1983) — were following Covacevich (1971) in her list of herpetological type-specimens in the Queensland Museum.

Covacevich (1971) listed QMJ255 and QMJ19742-3 with QMJ244, as syntypes but did not give her reasons for the decision under the entry for *Mocoa spectabilis*. However, she did give her criteria for determination of type status in the introduction, one of which was 'Notation in the register indicating that the specimen is a "Type" (or "co-type", "syntype", etc.)'. QMJ255 was listed as 'Co-types' (originally 3 specimens: 2 re-registered as QMJ19742-3) in the Queensland Museum register on 27 August, 1912, and it would have been for this reason that she accepted these specimens as syntypes. However, this is the only evidence and it is not adequate. Article 72(b)(vii) of the International Code of Zoological Nomenclature states that 'The mere citation of "Type" or equivalent expression, in a list of types, or in a catalogue of a museum, or on a label is not to be construed alone as evidence that a specimen is or is fixed as any of the kinds of types referred to in this Chapter'.

In summary, de Vis (1888) described *Mocoa spectabilis* from a single specimen, a holotype, which is QMJ244. The specimens of *S. basiliscus* (QMJ255 and QMJ19742-3) were not his type material and the recent lectotype designation of QMJ19743 by Wells & Wellington (1985) is invalid. Thus *Mocoa spectabilis* is a senior synonym of the taxon previously known as *Saproscincus galli* Wells & Wellington, 1985 and *S. spectabilis* (de Vis, 1888) the valid name for the taxon. Also, *S. basiliscus* (Ingram & Rawlinson, 1981) remains valid.

Acknowledgement

I thank Peter Jell and Robert Raven, Queensland Museum, for reading the manuscript and Mr E.P. Wixted for advice on Latin.

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REVISION OF *NEOSARMATIUM* SERÈNE AND SOH (CRUSTACEA: BRACHYURA: SESARMINAE) WITH DESCRIPTIONS OF TWO NEW SPECIES

P.J.F. DAVIE

Davie, P.J.F. 1994 06 01: Revision of *Neosarmatium* Serène and Soh (Crustacea: Brachyura: Sesarminae) with descriptions of two new species. *Memoirs of the Queensland Museum* 35(1): 35-74. Brisbane. ISSN 0079-8835.

Neosarmatium Serène & Soh, 1970, is revised and re-diagnosed. Crabs of this genus are primarily characterised by a deeply vaulted, sub-quadrate, carapace, with the anterolateral margins with 0-2 teeth behind the exorbital angles; the upper surface of the palm of the chelipeds is without pectinate crests and usually defined anteriorly by a swollen longitudinal ridge; the outer surface of the palm usually with a median longitudinal row and the dorsal surface of the dactyl often bearing spines or blunt teeth; the legs are of medium length, flattened, and broad. Twelve *Neosarmatium* species are recognised as valid, including two new species: *N. fourmanoiri* Serène, 1973, *N. indicum* (A. Milne Edwards, 1868), *N. inerme* (De Man, 1887), *N. integrum* (A. Milne Edwards, 1873), *N. laeve* (A. Milne Edwards, 1869), *N. malabaricum* (Henderson, 1893), *N. meinerti* (De Man, 1887), *N. punctatum* (A. Milne Edwards, 1873), *N. roundifrons* (A. Milne Edwards, 1869), *N. smithi* (H. Milne Edwards, 1853), *N. spinicarpus* sp. nov. and *N. trispinosum* sp. nov. Records of *Neosarmatium indicum*, *N. punctatum* and *N. malabaricum* have been confused, and the identities of these species have now been clarified after examination of the type specimens. The identity of *N. laeve* (A. Milne Edwards, 1869) as a senior synonym for *N. aequifrons* (Rathbun, 1914) and *N. ambonensis* Serène & Moosa, 1971, is clarified for the first time. *N. biroi* (Nobili, 1905) is considered a junior synonym of *N. integrum* (A. Milne Edwards, 1873). *Neosarmatium trispinosum* sp. nov. has long been confused with *N. smithi*, from which it can be easily separated by the shape and position of the teeth on the upper margin of the dactyl of the male cheliped. All records of *N. smithi* from the coast of Queensland, including published ecological studies, refer to *N. trispinosum* sp. nov. Lectotypes are designated for *Neosarmatium indicum* (A. Milne Edwards, 1868), *N. inerme* (De Man, 1887), *N. integrum* (A. Milne Edwards, 1873), and *N. punctatum* (A. Milne Edwards, 1873).□*Crustacea, Brachyura, Grapsidae, Sesarminae, Neosarmatium, mangroves, Indo-West Pacific, new species.*

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Crabs of the genus *Neosarmatium* are among the largest of the intertidal mangrove sesarmines. The species that have so far been studied are primarily herbivorous, and along with other sesarmines, appear to be responsible for consuming a large percentage of the annual leaf fall of mangrove forests (Robertson & Daniel, 1989; Robertson, 1991; Smith et al., 1991).

The present paper is the third (see Davie, 1992, 1993) in a projected series of works intended to revise the genus *Sesarma* s.l. and clarify and correct some of the problems that have arisen from Serène & Soh's somewhat premature 1970 paper diagnosing 10 new genera, and 3 new subgenera.

Neosarmatium was diagnosed by Serène & Soh (1970), to include a number of Indo-West Pacific species previously included in *Sesarma* (*Sesarma*) or *Sarmatium* Dana. Davie (1992) has revised *Sarmatium* and clearly defined its generic limits. Six of the species that were placed in *Sarmatium* by Tesch (1917): *S. integrum* A. Milne Edwards, 1873, *S. inermis* De Man, 1887, *S. indicum* A. Milne Edwards, 1868, *S. punctatum* A. Milne Edwards, 1873, *S. biroi* Nobili, 1905 (= *integrum*) and *S. fryatti* Tesch, 1917 (=*roundifrons* A. Milne Edwards, 1869) are now all included in *Neosarmatium*.

I have given references to non-taxonomic papers concerning some species. This listing is not meant to be exhaustive. It is primarily provided in an attempt to clarify cases where such authors have wrongly identified their study animals; and secondarily as an introduction to other biological studies.

While I have provided a full new description for most species, in several cases I have provided only a diagnosis because comprehensive and/or recent descriptions are available.

The descriptions for this paper were prepared

using the DELTA computer system for generating taxonomic descriptions (Dallwitz & Paine, 1986). Measurements given in the text are of the carapace breadth (measured at the widest point) followed by length. Leg segments were measured in a straight line to give maximum dorsal length and so are not always the maximum possible length. The exact limits of the width of the posterior margin of the carapace are also sometimes difficult to determine and in this work they were defined by the point at which the lateral carapace suture meets the posterior margin. Gonopod terminology follows that of Sakai & Yatsuzuka (1979).

ABBREVIATIONS USED: c.b., carapace breadth; Ck, Creek; BMNH, British Museum (Natural History); MNHN, Muséum national d'Histoire naturelle, Paris; ZRC, Zoological Reference Collection, Department of Zoology, National University of Singapore; NNM, National Natural History Museum, Leiden; NT, Northern Territory, Australia; ppt, parts per thousand; QLD, Queensland, Australia (ME.QLD = mid-eastern Queensland; NE.QLD = north-eastern Queensland etc.); QMW, Queensland Museum, Brisbane; SMF, Senckenberg Museum, Frankfurt; USNM, National Museum of Natural History, Washington; Z.D.U.Q., Zoology Department University of Queensland; ZMG, Zoological Museum of Goetingen (collection now housed at SMF); ZMH, Zoologisches Institut und Zoologisches Museum, Universität Hamburg; ZMK, Zoological Museum, University of Copenhagen.

SYSTEMATICS

Neosarmatium Serène & Soh, 1970

Metagrapsus: A. Milne Edwards, 1873: 308; De Man, 1880: 31; Kingsley, 1880: 212 [not *Metagrapsus* H. Milne Edwards, 1853: 188].

Neosarmatium Serène & Soh, 1970: 397, 405; Sakai, 1976: 665.

TYPE SPECIES

Sesarma smithi H. Milne Edwards, 1853, by original designation; gender is neuter.

DIAGNOSIS

Carapace sub-quadrate; greatest width behind exorbital angles; breadth greater than length. Carapace deeply vaulted; slightly convex laterally. Regions moderately well defined. Anterolateral margins with 0-2 teeth behind exorbital angle. Front moderately to strongly deflexed; with broad median concavity. Postfrontal lobes distinct. Orbital hiatus open. Basal segment of antennal peduncle with well developed outer tongue-like lobe. Inter-antennular septum relatively narrow. Pterygostomian region with well developed reticulation of intercrossing lines of setae. Third maxilliped merus and ischium subequal; merus longer than wide, outer margin convex; ischium sub-triangular; palp articulating near outer distal margin of merus; exopod narrow, reaching about half length of merus. Chelipeds subequal, large and robust; merus usually with distinct subdistal spine on posterior border; carpus with inner angle slightly produced; upper surface of palm usually, but not always, defined anteriorly by swollen longitudinal ridge; without pectinate crests; outer surface of palm punctate, naked, usually with median longitudinal row, without ventral ridge. Dorsal surface of dactyl usually bearing spines. Fingers pointed; curved slightly inwards; wide gape between cutting margins in adult males. Legs medium length, flattened, broad. Dactyli stout and slightly recurved; terminating in acute chitinous tip. Merus anterior margin with acute sub-distal spine; unarmed terminally. Carpus with accessory carinae on upper surface. Propodus with an accessory carina on inferior proximal portion of upper surface. Merus of last leg smooth, meri of other legs with scattering of small distally directed prickles. Male abdomen often remarkably elongate; relatively narrow; third segment widest; first segment broad, covering entire width of sternum between 4th pereiopods. G1 long, reaching just past suture between sternites 3 and 4; moderately stout to slender, curved; apical process present, corneous, strongly produced, straight; gonopore terminal; seta short, simple, lying around corneous tip and apical part of stem obscuring structural detail. G2 short, evenly tapering, slightly twisted, apically rounded.

Neosarmatium species recognised as valid in this paper: *N. fourmanoiri* Serène, 1973, *N. indicum* (A. Milne Edwards, 1868), *N. inerme* (De Man, 1887), *N. integrum* (A. Milne Edwards, 1873), *N. laeve* (A. Milne Edwards, 1869), *N. malaburicum* (Henderson, 1893), *N. meinerti* (De Man, 1887), *N. punctatum* (A. Milne Edwards, 1873), *N. rotundifrons* (A. Milne Edwards, 1869), *N. smithi* (H. Milne Edwards, 1853), *N. spinicarpus* sp. nov. and *N. trispinosum* sp. nov.

KEY TO THE SPECIES OF *NEOSARMATIUM*

(Although the key relies heavily on male claw characters, the female chelae usually show the same features, albeit much less obviously, and can therefore usually also be identified. Features enclosed in '[ ]' are included as extra, specific diagnostic characters).

1. Side of carapace without anterolateral teeth separated by a deep notch from the rest of the margin, a single anterolateral tooth may be present as an angular projection [Exorbital breadth sub-equal to length of carapace. Outer surface of palm of cheliped punctate; inner surface with a low granular crest. Colour: purple, chelipeds, pereiopods and edges of carapace reddish. Male unknown.] ..... *integrum* (A. Milne Edwards, 1873)
   Side of carapace with one or two anterolateral teeth (second usually reduced to an angular projection) 2

2. Dactyl of male cheliped with strong chitinous teeth on dorsal margin 3
   Dactyl of male cheliped either without strong chitinous teeth on dorsal margin, or bearing small, sharp, chitinous spinules only 9

3. Dactyl of male cheliped with 2 teeth on dorsal margin 4
   Dactyl of male cheliped with 3-5 teeth on dorsal margin 6

4. Inner surface of palm without a strongly raised, granular, vertical crest (4-5 granules may be prominent on large males but are not raised onto a crest); outer surface of male chela with a protruding basal shelf on fixed finger below gape ..... *N. indicum* (A. Milne Edwards, 1868)
   Inner surface of palm with a strongly raised, granular, vertical crest; male chela normal in form, not having a protruding basal shelf on fixed finger below gape 5

5. Distal tooth on upper surface of dactyl placed close to middle; upper surface of palm of cheliped with a strong longitudinal rim marking its outer edge; carapace 1.15-1.25 times longer than wide ..... *N. malabaricum* (Henderson, 1893)
   Distal tooth on upper surface of dactyl placed clearly less than half-way to the tip; longitudinal rim present on upper surface of palm of cheliped but not strongly differentiated; carapace 1.25-1.35 times longer than wide ..... *N. punctatum* (A. Milne Edwards, 1873)

6. Dactyl of male cheliped with 3 teeth on dorsal margin [carapace length c.1.1 times breadth; strong vertical crest on inside of chela; sixth segment of male abdomen strongly elongated] 7
   Dactyl of male cheliped with 4-5 teeth on dorsal margin 8

7. Dactylar teeth truncate, spaced evenly over proximal half ..... *smithi* (H. Milne Edwards, 1853)
   Dactylar teeth acute, set close together over proximal two-fifths ..... *trispinosum* sp. nov.

8. Carapace sub-quadrate, maximum carapace width between tips of first anterolateral teeth; 4 evenly spaced, dactylar tubercles; frontal margin without strong median concavity; median and lateral postfrontal lobes of similar width, and not swollen; small species ..... *laeve* (A. Milne Edwards, 1869)
   Carapace with lateral margins markedly convex anterolaterally, maximum carapace width behind tips of first anterolateral teeth; 4 dactylar tubercles; frontal margin with a strong median concavity; median postfrontal lobes wider than laterals, and strongly swollen; large species ..... *rotundifrons* (A. Milne Edwards, 1869)

9. Dactyl of cheliped smooth, unarmed [walking legs relatively slender, length of merus of third walking leg 2.6-2.7 times width; male first pleopod short, with distal portion not strongly narrowing, and not much twisted] 10
   Dactyl of cheliped armed with small, sharp, chitinous spinules 11

10. Inner angle of carpus of cheliped unarmed; inner face of palm with vertical row of granules behind gape ..... *inerme* (De Man, 1887)
    Inner angle of carpus of cheliped armed with acute granular projection; inner face of palm with a patch of granules ventrally but not extending as a vertical row behind gape ..... *spinicarpus* sp. nov.

11. Male chela c.1.7 times longer than high;

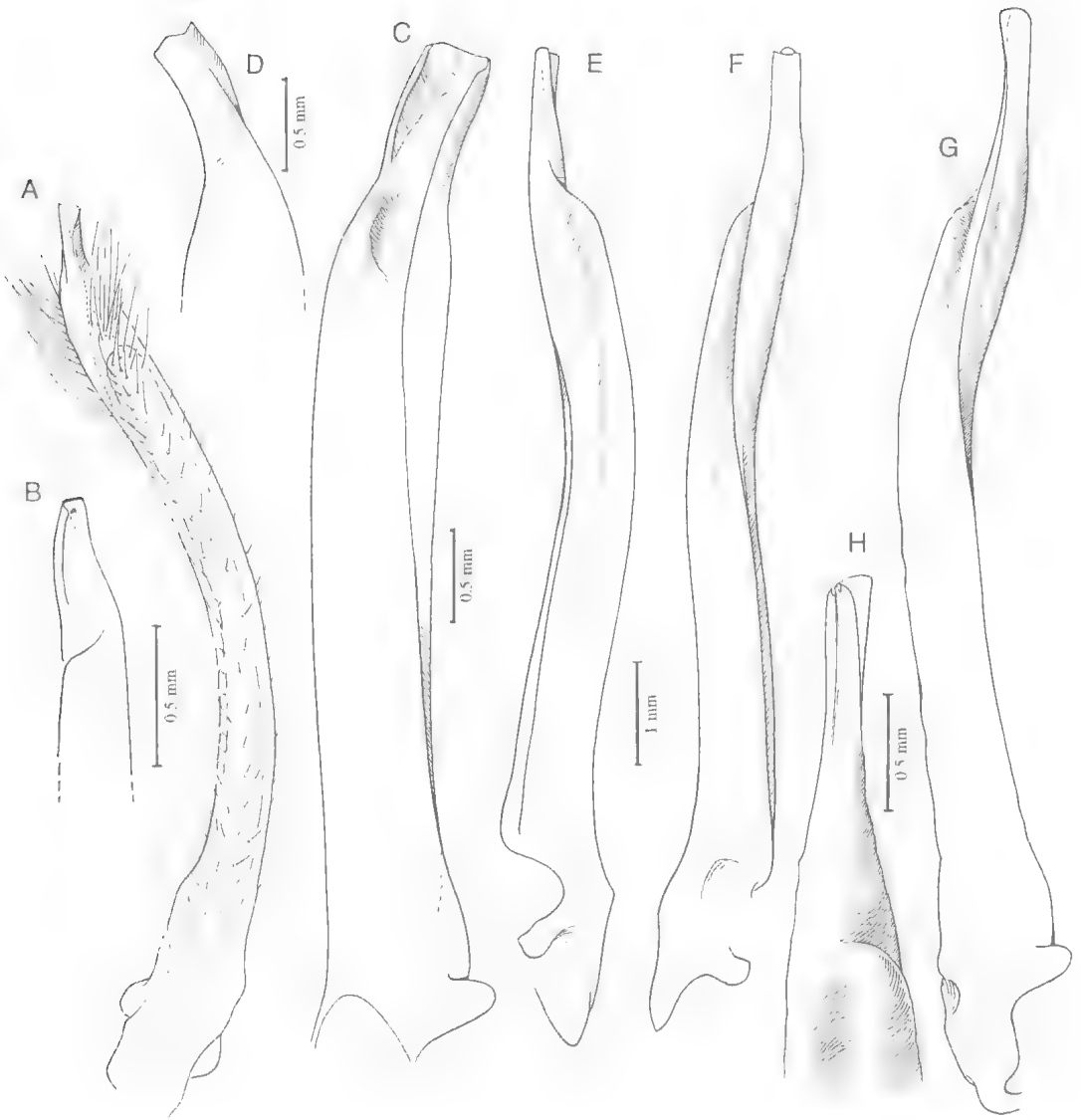

FIG. 1. Male first gonopods (setae removed except for A). A, B, *Neosarmatium laeve* (A. Milne Edwards) [specimen figured is the holotype of *N. aequifrons* (Rathbun)]; C, D, *N. inerme* (De Man), ZMH4080; E, F, *N. indicum* (A. Milne Edwards), ZRC1989.3670; G, H, *N. malabaricum* (Henderson), MNHN-B10461.

lower margin evenly convex; dactylar spinules evenly spaced in a single row, and extending only to about half length of dactyl; vertical granular row on inside of chela strongly developed . . . . . *meinerti* (De Man, 1887)

Male chela c.1.8 times longer than high; lower margin straight behind fixed finger; dactylar spinules more numerous, not confined to a single row, and extending almost to tip of dactyl; vertical granular row on inside of chela lower than in *N. meinerti* . . . . . *fourmanoiri* Serène, 1973

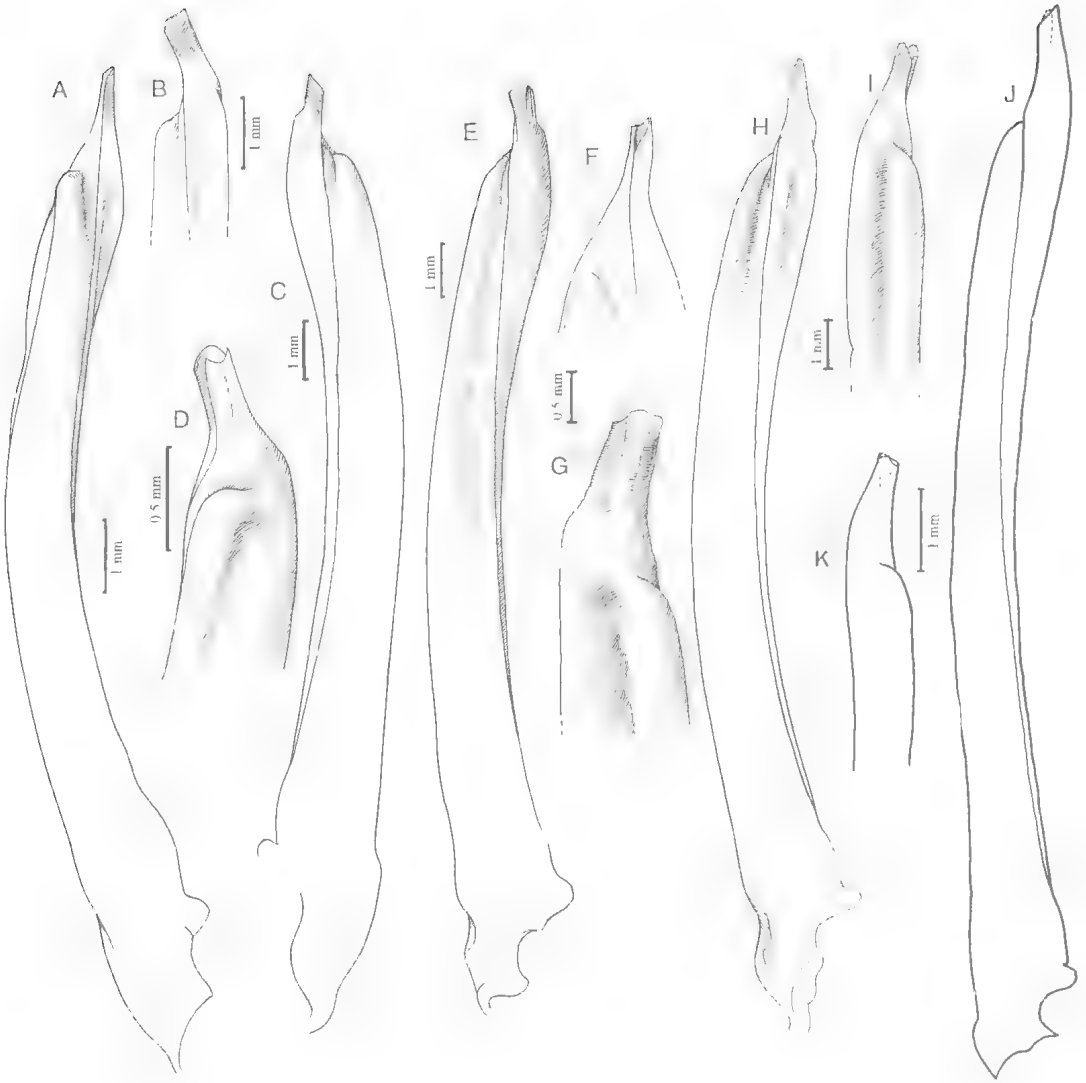

FIG. 2. Male first gonopods (setae removed). A, B, *N. rotundifrons* (A. Milne Edwards) [specimen figured is the holotype of *N. fryatti* (Tesch)]; C, D, *N. fourmanoiri* Serène, holotype, MNHN-B10459; E, F, G, *N. meinerti* (De Man), MNHN-B16735; H, I, *N. trispinosum* sp. nov., MNHN unreg., New Caledonia (41.2 x 36.4 mm); J, K, *N. smithi* (H. Milne Edwards), QMW8861.

Neosarmatium fourmanoiri Serène, 1973
(Figs 2C, D; 3; 16)

Sesarma tetragona: A. Milne Edwards, 1873: 304, pl. 16, fig, 4 [not *Cancer tetragona* Fabricius, 1798: 341].

? *Sesarma Meinerti*: Nobili, 1907: 405 [not *Sesarma meinerti* De Man, 1887] .

Sesarma meinerti: McCulloch, 1913: 322-23.

Neosarmatium fourmanoiri Serène, 1973. 126-129, pl.3 A-C.

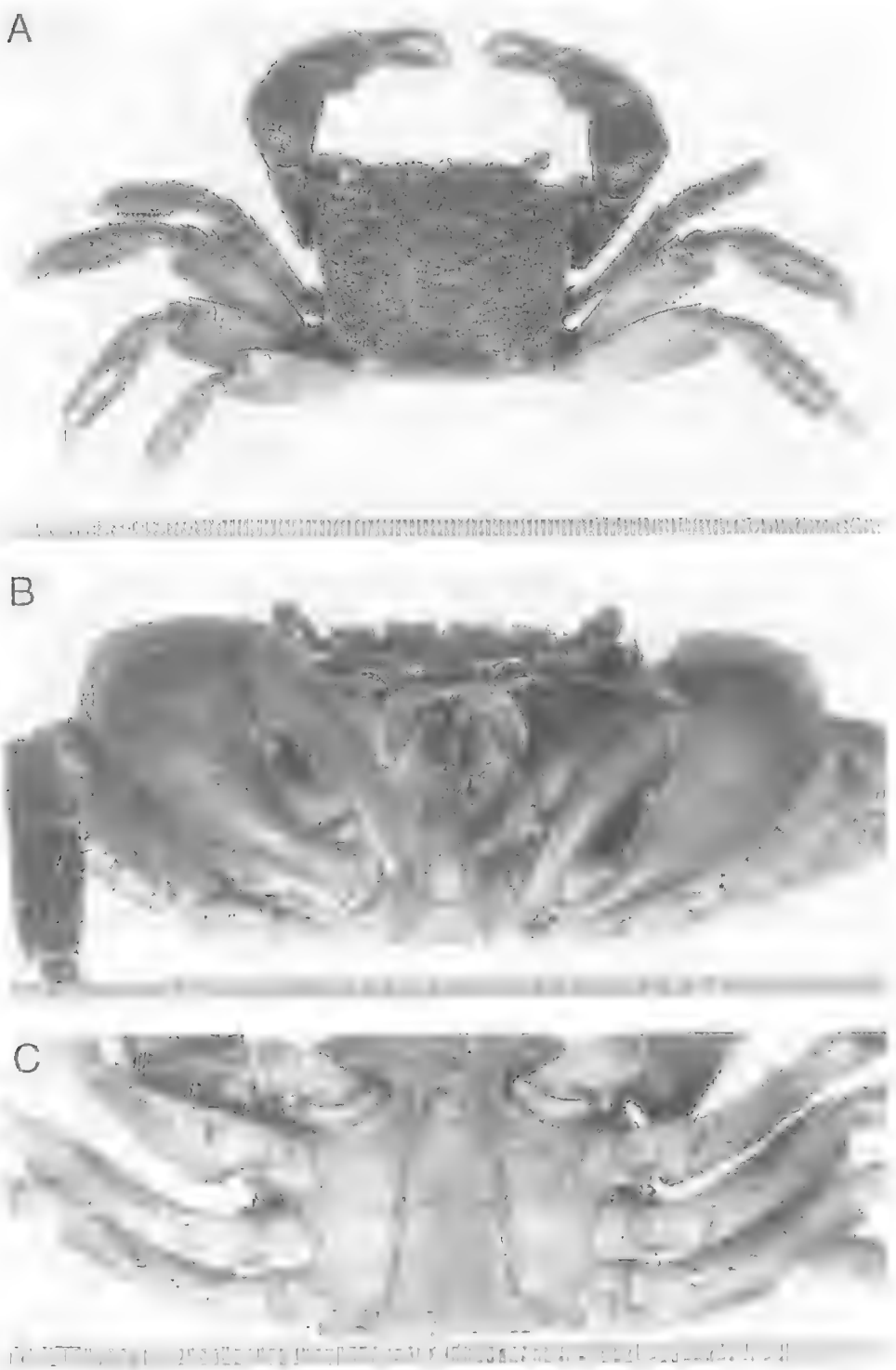

FIG. 3. *Neosarmatium fourmanoiri* Serène, 1973, ♂, QMW4598. A, dorsal view; B, frontal view; C, ventral view. Scale line in mm.

TYPE INFORMATION

Holotype, MNHN-B10459. Type locality: New Caledonia.

MATERIAL EXAMINED

HOLOTYPE: MNHN-B10459, ♂ (38.3 x 31.7mm), New Caledonia, R. Serène, 4.9.1971.

OTHER MATERIAL: NEW CALEDONIA: QMW-19558, ♂ (44.1 x 36.6mm), Pam, north New Caledonia, mangroves, 27.2.1992, J. Menou. VANUATU: MNHN unreg., ♂ (38.9 x 31.6mm), *Rhizophora*/*Xylocarpus* mangroves, in lagoon by Banana Plantation, R. Serène, 10.10.1971; MNHN unreg. (Serène coll.), ♀ (36.0 x 28.0mm), Port Stanley, tidal edge at high water, *Rhizophora*/*Ceriops* interface, A.G. Marshall, 2.10.1971. INDONESIA: NNMD170, ♂ (35.0 x 29.2mm), Sula Senana, E. of Sulawesi; NNMD169, ♀ (26.2 x 21.2mm), Sulawesi; NNMD1539, ♂ (41.4 x 35.4mm), ♀ (38.1 x 32.0mm), Pacific Ocean [Museum Godeffroy 1887]; NNMD40838, 4♀ (30.9 x 24.6; 30.4 x 29.0; 34.9 x 28.0; 35.5 x 28.3mm), from burrows among trees just behind beach, Holtekang, southern part of Humboldt Bay, near Buaja River, northeastern coast of Irian Jaya, New Guinea, L.B. Holthuis, 12.11.1954. AUSTRALIA: QMW8843, 2♂ (33.1 x 26.5; 30.4 x 24.7mm), Port Stewart, NE.QLD, 14°04'S, 143°41'E, B. Campbell, night collected; SMF unreg., ♀ (29.0 x 22.5mm), ♂ (37.9 x 29.4mm), upper edge of bank under stones and logs, Smith Creek, Cairns, NE.QLD, M. Türkay, 5.6.1980; QMW8841, ♂ (38.5 x 31.0mm), ♀ (30.0 x 23.4mm), Cairns side of Yorkey's Knob, NE.QLD, 5 ppt, 16°49'S, 145°43'E, 14.1.1965, B. Campbell; QMW8844, ♂ (36.8 x 29.5mm), Barron River, NE.QLD, 16°52'S, 145°42'E, Z.D.U.Q.; QMW8840, 4♂ (27.7 x 21.4 - 35.4 x 29.0mm), 5♀ (27.1 x 21.5 - 29.8 x 23.3mm), Airport Swamp, Cairns, NE.QLD, 16°53'S, 145°45'E, Z.D.U.Q.; QMW1123, (dried varnished spec.), Barron Beach, via Cairns, NE.QLD, 16°55'S, 145°46'E; QMW8842, ♂ (33.9 x 26.5mm), Trinity Inlet, Cairns, NE.QLD, 16°58'S, 145°47'E, 5.12.1975, Australian Littoral Society; QMW4598, ♂ (34.7 x 29.3mm), nth end of Admiralty Is., Trinity Inlet, Cairns, NE.QLD, 16°58'S, 145°47.0 E, Jan. 1975, M. Graham, found in entrance to burrows in Blady Grass on the edge of a terrestrial ridge amongst the open (4-5m) *Xylocarpus*, *Ceriops*, *Lumnitzera racemosa* and *L. littorea* mangroves; QMW8879, ♀ (31.1 x 23.7mm), Road to Lucinda, near Ingam, NE.QLD, 18°32'S, 146°2'E; QMW8845, ♂ (43.5 x 34.5mm), Townsville, NE.QLD, 19°16'S, 146°49'E, Z.D.U.Q.; QMW12901, 1♂, mangroves behind Gap Beach, Lindeman Is., ME.QLD, 20°27'S, 149°02'E, 25.3.1987, P.Davie, J.Short; QMW12902, 2♂, mangroves behind Gap Beach, Lindeman Is., ME.QLD, 20°27'S, 149°02'E, 27.3.1987, P.Davie, J.Short.

DESCRIPTION

Carapace. c.1.2 times broader than long. Fronto-orbital width c.1.1 times carapace length. Depth c.0.7 times carapace width. Cardiac region distinct. Lateral margins slightly convergent posteriorly; slightly convex, or straight. Anterolateral margins with a single epibranchial tooth. Exorbital angle triangular and sharp. Anterolateral tooth triangular and sharp; similar in size to exorbital angle. Front c.0.55 times carapace width; c.0.6 times fronto-orbital width; pre-orbital concavity present; lateral margins parallel and convex. Post-frontal lobes with clumps of stout setae meeting over frontal furrow, and each with fringe of prominent dark setae. Short ridge medially on first epibranchial tooth. Branchial ridges prominent; first follows from typical position of second epibranchial tooth, relatively long; second arising just short of lateral margin; other ridges also arise near lateral margin; last ridge long, curved over base of last leg. Posterior margin c.0.4 times carapace width. Carapace surface smooth, shining, punctate; wrinkled posteriorly. Soft setae arranged sparsely on branchial lines and in short rows over entire surface; longest and most conspicuous over anterior half, almost lost on intestinal region. Upper orbital border smooth, slightly oblique; moderately convex mesially; inner angle rounded. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.3 times width of front.

Third maxilliped. Suture between merus and ischium obliquely sloping inward. Ischium inner margin smooth. Exopod narrow, barely visible in frontal view; c.0.5 times width of ischium.

Chelipeds. Merus with posterior border bearing minute granular striations; without distinct subdistal spine; lower border granulate; anterior border tuberculate, tubercles larger in proximal half; carpus with inner angle not produced; inner margin granular, rectangular facet more-or-less defined by two granular ridges; males (but not females) lacking brush of stiff setae on ventroproximal end of this facet characteristic of other species; granules present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm not defined anteriorly by a longitudinal ridge. Outer surface of palm naked, microscopically granular, punctate, without median longitudinal row. Inner surface of palm minutely granular; with a low vertical band of

small granules. Immovable finger rounded on outer surface; moderately long; length cutting edge c.0.46 times length propodus. Ventral border of chela straight, or slightly convex. Dorsal surface of dactyl minutely granular. Fingers with tips, corneous, toothed, intermeshing; curved inwards; a moderate gape between cutting margins.

Walking legs. Second pair the longest, c.1.7 times maximum carapace width. Merus of third leg c.2.3 times as long as wide. Carpus c.2.3 times as long as wide. Propodus c.2.1 times as long as wide. Dactyli about equal to length of propodi. Meri of legs 1-3 with scattering of small distally directed prickles, arranged on transverse crests in upper part. Meri generally without setae except for some longer bristles ventrally; carpi and propodi bear a thick fur of soft setae on anterior and posterior margins, most extensive on the first two pairs where the setae also cover most of the ventral face of these segments, but reduced to a sparse, narrow, vestige on last pair; setae continue onto dactyli in narrow rows.

Male abdomen. Segment 1 narrow, c.0.9 times width segment 3. Width segment 3 c.4.2 times length. Segment 6 elongated; 1.1 times wider than long. Telson much shorter than segment 6; slightly shorter or subequal to segment 5; c.1.3 times longer than wide; evenly rounded.

Gonopods. G1 inner-dorsal margin straight and distally curved inward. Dorsal surface of stem flattened; completely calcified. Palp present, poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem convex. Distal part of the stem broad. Apical process present, corneous, moderately produced, straight. Gonopore terminal. Setae long and displaced around apex, obscuring structural detail. G2 short, straight, narrow, evenly tapering, slightly twisted.

Colour

The carapace and walking legs are a dark violet brown, nearly black. The chelipeds are a uniform bright dark red or (rarely) dark purplish.

Remarks

Neosarmatium fourmanoiri bears a very close resemblance to *N. meinerti*. The main differences are:

1. The chelae of *N. fourmanoiri* are proportionately not as high, the mean length to height ratio being 1.81 compared to 1.70 in *N. meinerti* although there is some overlap between individual specimens; 2. The gape between the fingers of adult male *N. fourmanoiri* is comparatively much less than in *N. meinerti;* 3. The vertical crest on the inside of the palm of *N. meinerti* has a single even row of comparatively much larger tubercles; 4. The chitinous tubercles on the superior margin of the finger in *N. fourmanoiri* are fine, and form a broad band which extends almost to the tip. In *N. meinerti* they are coarser, uniform in size, evenly spaced in a single row, and only extend over the proximal half; 5. On the male chelae of *N. fourmanoiri* the outer edge of the articulation joint with the dactyl is oblique, and continues onto the cutting margin in a long smooth shallow continuous arc; in *N. meinerti* the edge of the joint is much more vertical and meets the fixed finger in a more angular fashion; 6. On the male chelae of *N. fourmanoiri* the lower border of the palm is more-or-less straight behind the fixed finger, whereas in *N. meinerti* it is evenly convex; 7. The carpus of the male cheliped of *N. fourmanoiri* lacks a brush of stiff setae below the inner proximal end of the rectangular facet; 8. The hirsute areas of the carapace are relatively denser in *N. fourmanoiri* than in *N. meinerti;* 9. Live colouration is different (see Descriptions).

The abdominal segments and the first male pleopod show no appreciable differences.

Female specimens of both species are difficult to distinguish. The most useful characters seem to be the development of the granular row on the inside of the palm of the chela (stronger in *N. meinerti*) and the dactylar tubercles which are more numerous on *N. fourmanoiri* and continue most of the way to the tip, whereas on *N. meinerti* they finish about half way down.

Habitat

From estuaries or mangrove swamps in large burrows (about 5cm diameter). Occurs in a variety of micro-habitats and mangrove forest types - among *Sesuvium* near H.W.S.; in open, well above H.W.S.; in entrance to burrows in Blady Grass on the edge of a terrestrial ridge amongst open (4-5m) *Xylocarpus, Ceriops, Lumnitzera racemosa* and *L. littorea* mangroves; in wet *Rhizophora* zone mangroves behind sandy beach; tidal edge at high water, *Rhizophora/Ceriops* interface; upper edge of bank under stones and logs. The burrows extend through firm mud or even hard earth for about 1m to the water table. Recorded salinities cover a wide range from <1 ppt L.W.N. (21 ppt in stagnant pools) at Ross Ck., to >33 ppt in a ditch beside the road to Lucinda.

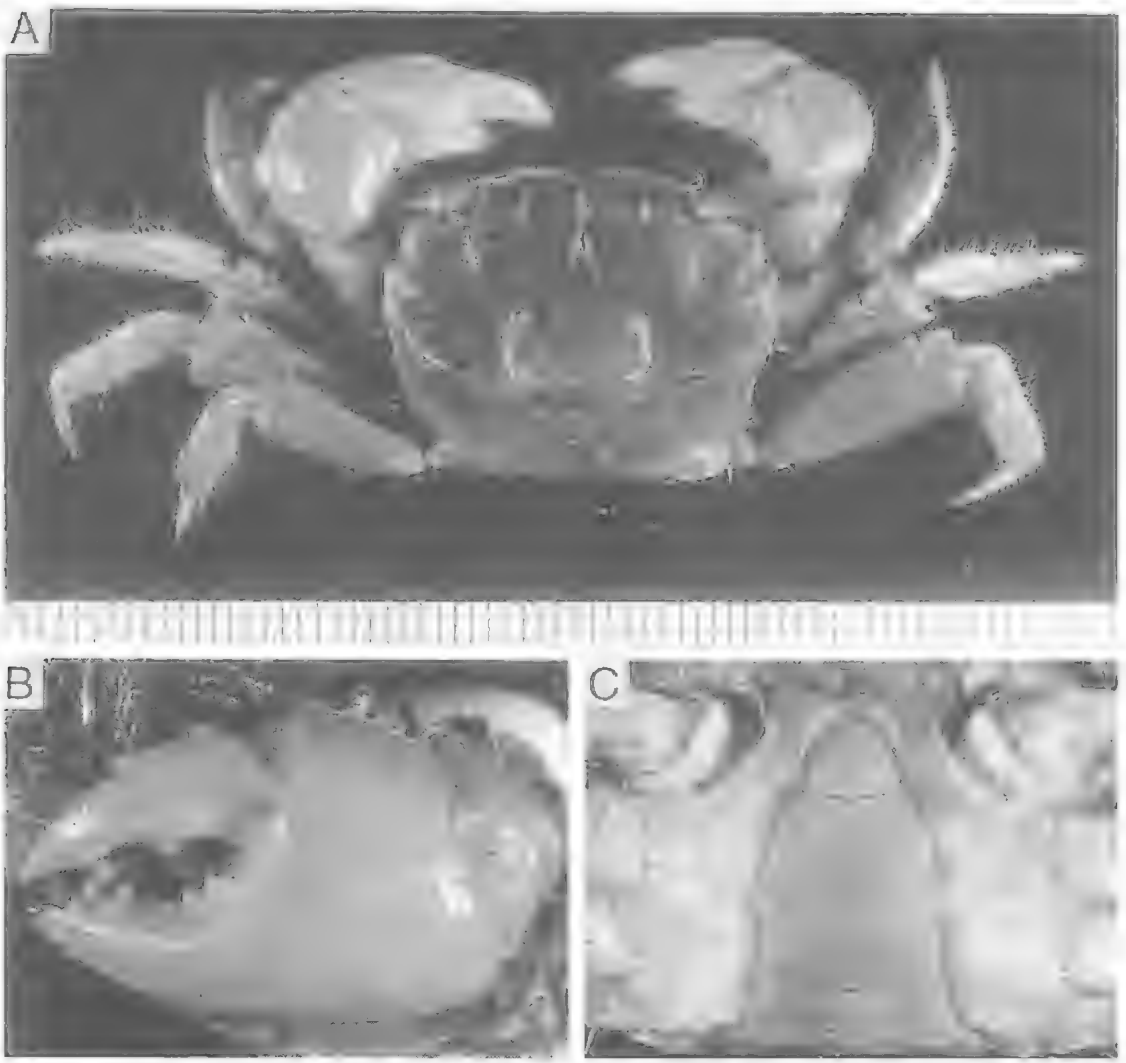

FIG. 4. *Neosarmatium indicum* (A. Milne Edwards, 1868), ♂, ZRC1975. 6.30.15. A, dorsal view; B, chela; C, sternum and male abdomen. Scale line in mm.

DISTRIBUTION

New Caledonia (Serène, 1973); from Lindeman Is., ME.QLD, to Port Stewart, Princess Charlotte Bay, NE.QLD; Vanuatu; northeastern coast of Irian Jaya, New Guinea, to Sulawesi, Indonesia (present records). Nobili's (1907) record of *N. meinerti* (no discussion or figure provided) from Apia, Samoa is probably also *N. fourmanoiri*.

Neosarmatium indicum (A. Milne Edwards, 1868)
(Figs 1E, F; 4; 17)

Metagrapsus indicus A. Milne Edwards, 1868b: 174, pl. 26, figs 1-5.

? *Sesarma indica*: Heller, 1865: 64 (in part, probably the specimens from the Nicobars refer to valid *N. indicum*) [not *Sesarma indica* H. Milne Edwards, 1837 (=*Tiomanium indicum*)].

Metagrapsus punctatus: De Man, 1880: 31.

Sarmatium indicum: Kingsley, 1880: 350 (no new specimen); De Man, 1887: 660 (no new specimen); 1892: 350; Tesch, 1917: 220.

Sarmatium punctatum: Tesch, 1917: 221; 1918: 115.
? *Sarmatium punctatum*: Urita, 1926: 20; Sakai, 1934: 325.
Sesarma (Sarmatium) punctata: Tweedie, 1940: 109; 1950b: 353.
Sesarma punctata: Tweedie, 1950a: 94.
Neosarmatium punctatum: Soh, 1978: 10, pl. 3b.

TYPE INFORMATION

Lectotype, here designated, MNHN-B10927. Type locality: Celebes (= Sulawesi), Indonesia.

MATERIAL EXAMINED

LECTOTYPE: MNHN-B10927, ♂ (25.9 x 20.9 mm), Celebes, Indonesia, M. Riedel.

OTHER MATERIAL: INDONESIA: NNMD187, ♂ (26.6 x 20.9mm), Padang, W. Sumatera [specimen examined by De Man (1880) and Tesch (1917) and identified as *punctatum*]. MALAYSIA: ZRC1965.8.3.38-39, 2 ♂ (16.2 x 13.0; 19.3 x 15.1 mm), Labuan, Sabah, coll. 1938; ZRC1964.9.8.14-19, ♂, 5♀ (not measured), Pulau Aor, M.W.F.Tweedie, 1950; ZRC1970.2.20.2, ♂ (not measured), Pulau Tioman, K. Romimohtarto, 1968; ZRC1991.351, ♀ (not measured), Tekek Bay, Pulau Tioman, P. Ng, 23.6.1983. SINGAPORE: ZRC1989 3670, ♂ (22.8 x 18.1mm), Sungei Buloh mangroves, Singapore, P.K.L. Ng, 1986. HONG KONG: ZRC1975.6.30.15, ♂ (24.3 x 19.9 mm), Tai Tam, Hong Kong Island, C.L. Soh, 12.6.1975.

DESCRIPTION

Carapace. c.1.2-1.3 times broader than long (mean 1.25). Fronto-orbital width c.1.1 times carapace length. Depth c.0.7-0.75 times carapace width. Cardiac region distinct. Lateral margins slightly convergent posteriorly; slightly concave, with one anterolateral tooth behind the exorbital angle; second reduced to an angular projection only. Exorbital angle and first anterolateral tooth triangular and sharp; similar in size. Front c.0.52-0.55 times carapace width; c.0.59-0.64 times fronto-orbital width; moderately deflexed; weakly bilobed, almost straight; lateral angles obtuse, blunt. Post-frontal lobes without clumps of setae Short ridge medially on first epibranchial tooth. Branchial ridges prominent; first relatively long; second arising from near lateral margin; 2-3 others also arise just inside lateral margin; last one forms strong ridge curving over base of last legs. Posterior margin c.0.47-0.51 times carapace width. Carapace surface smooth, shining, and minutely punctate. Setae arranged in scattered tufts on branchial lines, otherwise confined to posterolateral corners. Upper orbital border evenly microscopically granular. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.31-0.36 times width of front.

Third maxilliped. Merus c.0.9 times length of ischium. Suture between merus and ischium obliquely sloping inward. Ischium inner margin smooth or microscopically granular.

Chelipeds. Merus with posterior border minutely granulate; with blunt subdistal projection; lower border granulate, with small, triangular, subdistal spine; anterior border coarsely granulate but smooth on distal third; carpus with inner angle and inner margin granular, a secondary ventral granular ridge bearing a short row of long setae proximally; tubercles present on inner face of carpus just below inner angle; outer margin with granular striations. Upper surface of palm defined anteriorly by a swollen longitudinal ridge. Outer surface of palm coarsely punctate, naked; without median longitudinal row. Inner surface of palm sparsely granular; with vertical row of 4-5 prominent granules behind gape, and 2-4 granules obliquely behind base of fixed finger. Immovable finger slightly flattened on outer surface; basally produced outward forming a prominent, elongate, triangular shelf over proximal three-quarters of finger, obliquely sloping outward. Length cutting edge c.0.41-0.44 times length propodus. Ventral border of chela convex. Dorsal surface of dactyl bearing 2 large, bluntly pointed, chitinous tipped tubercles on superior inner margin, similar size and shape, one medial, one near proximal end. Fingers pointed, lower finger with tip notched such that dactyl intermeshes; curved inwards; a moderate gape between cutting margins.

Walking legs. First three pairs all of similar length, c.1.5 times maximum carapace width. Merus of third leg c.1.8-2 times as long as wide. Carpus c.1.85-2.2 times as long as wide. Propodus c.1.4-1.65 times as long as wide. Dactyli c.1-1.2 times length of propodus. Carpi and propodi bear a short felt of setae on their upper halves, coverage less extensive on last legs; continues in thin rows onto dactyli.

Male abdomen. Width segment 3 c.4.3-4.6 times length. Segment 6 not elongated; 1.5-1.6 times wider than long. Telson slightly shorter than segment 6; 1.1-1.2 times longer than wide; evenly rounded.

Gonopods. G1 long, slender, curved. Inner-dorsal margin straight. Dorsal surface of stem flattened; completely calcified. Palp poorly developed, not separated from stem, large, rounded, calcified. Outer dorsal margin of stem

convex. Distal part of the stem narrow. Apical process corneous, strongly produced, straight. Gonopore terminal. Setae long, simple, lie around distal part of stem as for other species. G2 short, twisted.

Sternum. Sternum anterior to telson densely setose, setae continuing on the ischia of third maxillipeds.

Colour

'In life the carapace is dark purplish brown, irregularly marked with light brown near the posterior border. The legs are light brown with dark spots and the chelae bright red' (Tweedie, 1940: 109). 'In colour this species much resembles *Sesarma bidens* ... the walking legs are, however, mottled with much larger and rounded reddish-violet blotches' (Tesch, 1918: 115, as *Sarmatium punctatum*). 'The chelae are bright red all over, the carpus and merus are red with dorsal patches of purple, and the carapace and legs are a dull purplish brown' (P. Ng, in litt.). A colour photograph of the specimen ZRC1991.351 has been published (Ng, 1986).

Remarks

The dry specimen that I have designated the lectotype was not noted as a type in the Paris Museum, but it did have a label identifying it as coming from the Celebes, and collected by M. Riedel. It is the only specimen now in the Paris Museum that could be the type, however it also does not agree with the size of the specimen given by A. Milne Edwards (27 x 26 mm) which I consider to be in error as both the figure and all other specimens examined are considerably more broad than long. The possibility therefore must exist that A. Milne Edwards had several specimens at his disposal and that the specimen still existing is not the one specifically mentioned by A. Milne Edwards (1868). Because of this I am following ICZN Article 74b which notes that in cases where no original holotype was designated, and the amount of syntype material is uncertain, that a lectotype should be designated.

Neosarmatium indicum, *N. punctatum* and *N. malabaricum* have been very confused, and it is difficult to separate the records with certainty without examining all the material. *N. indicum*, although close to the latter two species, is very easily separated on the form of the claw, with its protruding basal shelf on the fixed finger of the cheliped of the male; and the lack of a strong tubercular vertical ridge on the inner face of the palm of the cheliped. It seems certain then that all the material identified by Tweedie (1940, 1950 a,b) as *N. punctata* is referable to *N. indicum* as the specimens of his examined for this study are all *N. indicum*. He stated in his 1940 paper that he identified his specimens from sketches of the type made by Dr I. Gordon, but these must not have shown the characteristic chela shape clearly. Soh's (1978) record of *N. punctatum* from Hong Kong was examined and it is certainly *N. indicum*. This is thus the northern-most confirmed record of any of these three species. There is an obscure record of *N. punctatum* from Kagoshima Prefecture in southern Japan, by Urita (1926) and re-cited in Sakai (1934) but not mentioned in Sakai's (1976) 'Crabs of Japan and the adjacent seas', and therefore its status must remain in doubt.

Thallwitz (1891) recorded *N. punctatum* from Manado in northern Celebes (Sulawesi) which is the type locality for *N. indicum*. He particularly noted the row of granules on the inside of the palm of the cheliped which is a characteristic of *N. punctatum*, and this suggests that his identification was correct, however there is still some doubt as one large male of *N. indicum* examined (NNMD187) has a distinct row of granules on the inner face of the palm which, although not nearly as strong as on *N. punctatum*, may have been what Thallwitz described.

Habitat

'In deep holes in the banks of a small stream near its entry into the sea and could only be collected at night; even then they were wary and difficult to catch' (Tweedie, 1940: 109). From a brackish swamp (Tweedie, 1950b). 'In a freshwater stream not subjected to any tidal influence and without real mangroves about. It looked typically freshwater' (P. Ng, in litt.)

Distribution

Only confirmed from the following localities. Celebes (Sulawesi) (type locality: A. Milne Edwards, 1868b) - Aor and Tioman Islands, Malaysia, South China Sea (Tweedie, 1940; present record) - Labuan, Sabah, Borneo (Tweedie, 1950a) - Hong Kong (Soh, 1978; present identification) - Singapore (present record) - Padang on the southwestern coast of Sumatera, Indian Ocean (Tesch, 1917, 1918, as *S. punctatum*).

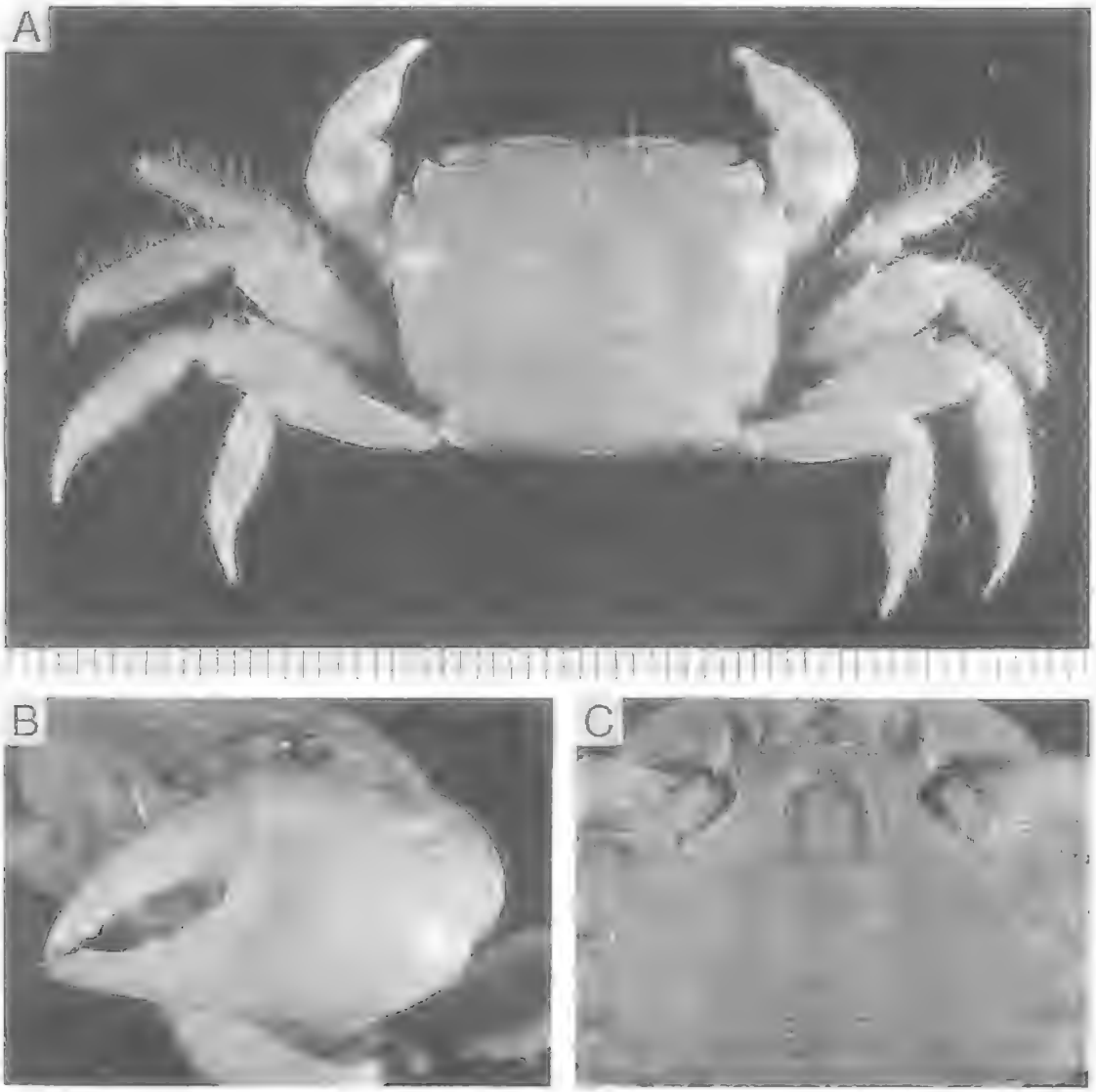

FIG. 5. *Neosarmatium inerme* (De Man, 1887), ♂, ZMH4080. A, dorsal view; B, chela; C, sternum and male abdomen. Scale line in mm.

Neosarmatium inerme (De Man, 1887)
(Figs 1C, D; 5; 15A, C, E; 16)

Sarmatium inerme De Man, 1887: 660, 687; Tesch, 1917: 221.
Neosarmatium inermis: Serène & Soh, 1970: 398, 405.

TYPE INFORMATION

Lectotype, here designated, ♂ (20.6 x 17.9 mm), MNHN-B3629; paralectotype, ♂ (20.6 x 18.9 mm), same registration. Type locality: Paulo [=Pulau] Condor [now Con Son], Vietnam.

MATERIAL EXAMINED

SYNTYPES: MNHN-B3629, 2♂ (20.6 x 17.9; 20.6 x 18.9 mm), Con Son, Vietnam, South China Sea.

OTHER MATERIAL: ZMH-K4080, 8♀ (17.5 x 14.2; 16.9 x 13.6; 17.8 x 14.5mm; 17.7 x 14.7; 19.1 x 15.5; 18.6 x 15.1; 20.3 x 16.4mm), 3♂ (13.9 x 11.8; 18.5 x 15.0mm; one unmeasured), Saigon River, Saigon, Vietnam, Capt. W. Schwinghammer, 18.10.1908.

DESCRIPTION

Carapace. 1.1-1.24 (mean 1.22) times broader than long. Fronto-orbital width c.1-1.1 times carapace length. Depth c.0.75-0.8 times carapace width in adults, less in small specimens. Cardiac region distinct. Lateral margins subparallel or slightly divergent; almost straight, or slightly concave. Anterolateral margins with two teeth behind the exorbital angle. Exorbital angle and first anterolateral tooth triangular and pointed; similar in size. Second anterolateral tooth blunt; much smaller than first. Front c.0.5 times carapace width; 0.53-0.59 times fronto-orbital width (mean 0.56); moderately deflexed; with deep, broad median emargination; lateral margins slightly diverging posteriorly. Post-frontal lobes without clumps of setae. Ridge medially on first anterolateral tooth. Branchial ridges more-or-less prominent; first follows from posterior edge of last epibranchial tooth, relatively short; followed by a series of short broken granular striations, except for last which forms strong ridge continuing over base of last legs. Posterior margin c.0.5 times carapace width (one specimen aberrant at 0.6). Carapace surface smooth, shining, punctate; setae arranged sparsely on branchial lines, mainly confined to posterolateral branchial regions. Upper orbital border evenly, minutely, granular. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.29-0.33 times width of front.

Third maxilliped. Suture between merus and ischium obliquely sloping slightly inward. Ischium inner margin smooth or microscopically granular.

Chelipeds. Merus with posterior border minutely finely striated; with blunt subdistal projection; lower border granulate, without subdistal spine; anterior border coarsely granulate, but smooth on distal third; carpus with inner angle rounded and granulate; inner margin granular, a secondary ventral granular ridge bearing a short row of long setae proximally; tubercles present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm sometimes with a longitudinal ridge slightly indicated; otherwise smooth. Outer surface of palm smooth, naked, with minute smooth flat granules; with more-or-less discernible median longitudinal row. Inner surface of palm granular mesially; with a vertical row of larger granules but not elevated into a crest. Immovable finger rounded on outer surface; moderately long, length cutting edge c.0.43-0.44 times length propodus. Ventral border of chela straight to slightly convex. Dorsal surface of dactyl smooth, rounded. Fingers pointed, lower finger notched behind tip so that dactyl intermeshes, curved inwards, a moderate gape between cutting margins.

Walking legs. Second and third pairs sub-equal and slightly longer than others, c.1.8 times maximum carapace width. Merus of third leg c.2.6-2.7 times as long as wide. Carpus c.2.3-2.7 times as long as wide. Propodus c.2-2.5 times as long as wide. Dactyli c.1-1.1 times length of propodus. Upper margins of meri granular, sometimes with some sharp spinules; posterior margins finely granular. Carpi and propodi bear a short felt of setae on upper and lower faces, more-or-less covering anterior face of first two pairs, less so on last two pairs.

Male abdomen. Male abdomen not remarkably elongate; moderately broad; segment 3 the widest, first three segments of similar width. Width segment 3 c.5.1-5.5 times length. Segment 6 not elongated, 1.75-1.85 times wider than long. Telson longer than preceding segments; 1.1-1.15 times longer than wide; evenly rounded.

Gonopods. G1 moderately stout; slightly curved. Inner-dorsal margin slightly curved. Dorsal surface of stem flattened; completely calcified. Palp absent, position indicated by a slight expansion of inner dorsal margin. Outer dorsal margin of stem moderately convex. Distal part of the stem broad, G1 apical process corneous; moderately produced; straight. Gonopore terminal. Setae long; feathered. G2 short, slender, tapering, moderately twisted.

Sternum. Sternum anterior to telson densely setose, setae continuing on the ischia of third maxillipeds.

REMARKS

Neosarmatium inerme and the closely related *N. spinicarpus* sp. nov. are aberrant within *Neosarmatium* by having more slender walking legs and by the much shorter, stockier male first pleopod, which has the distal portion short, not strongly narrowed, and only slightly twisted compared with other *Neosarmatium* species. These characters are possibly sufficient to warrant removal from *Neosarmatium* but as the allied genera remain to be revised no action is being taken at this time.

HABITAT

Not recorded.

DISTRIBUTION

Known from Con Son (type locality), and

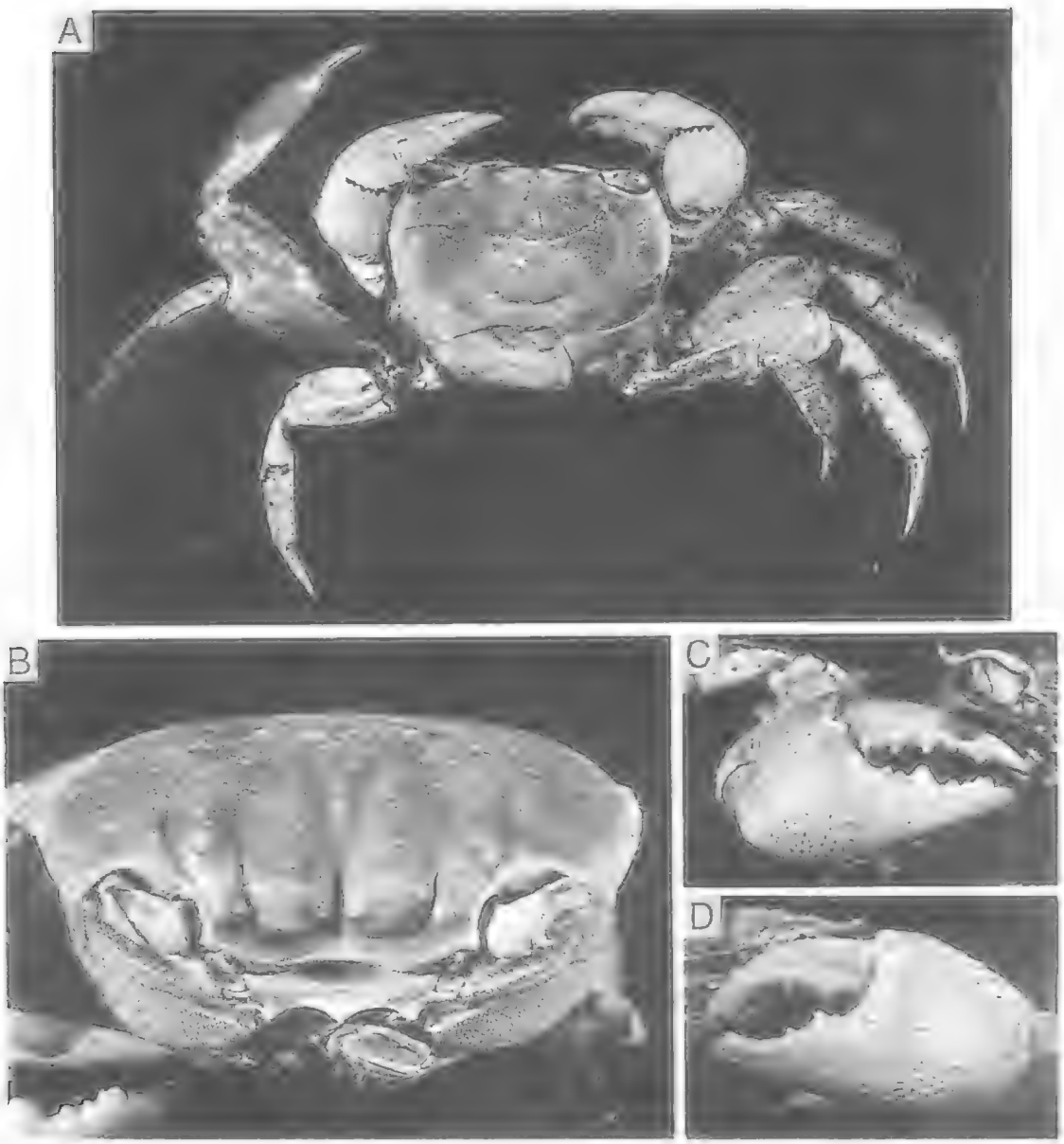

FIG. 6. *Neosarmatium integrum* (A. Milne Edwards, 1873). A-C, paralectotype ♀ (34.6mm carapace breadth); D, lectotype ♀. A, dorsal view; B, frontal margin; C, right chela D, left chela.

Saigon, Vietnam, South China Sea (present record).

Neosarmatium integrum (A. Milne Edwards, 1873)
(Figs 6, 7, 18)

Metagrapsus integer A. Milne Edwards, 1873: 309, pl. 17, fig. 3.

Sarmatium integrum: De Man, 1887: 660; Tesch, 1917: 221.

Sarmatium birói Nobili, 1905: 498-501, text-fig. 2; Tesch, 1917: 213-214 (no specimen).

Neosarmatium biroi: Serène & Soh, 1970: 398, 406 (in list); Forró & Müller, 1985: 78, figs 4-8.

Neosarmatium integrum: Serène & Soh, 1970: 398, 405.

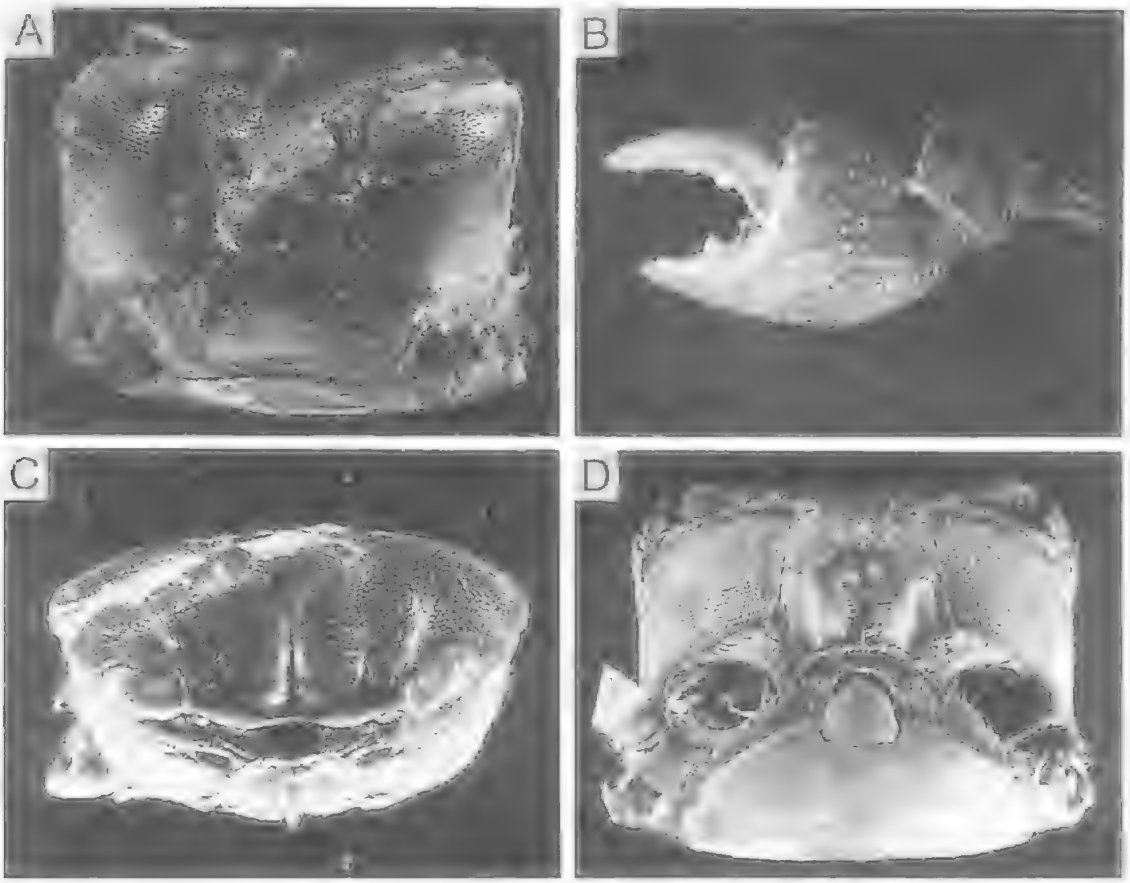

FIG. 7. *Neosarmatium integrum* (A. Milne Edwards, 1873), ♀, holotype of *Neosarmatium biroi* (Nobili, 1905). A, dorsal view; B, left cheliped; C, frontal margin; D, ventral view.

TYPE INFORMATION

Lectotype here designated, ♀ (39.0 x 30.8 mm), paralectotype, ♀ (34.6 x 27.5 mm), MNHN-B3628, Type locality; New Caledonia.

N. biroi: Holotype, Hungarian Natural History Museum, Budapest, Hungary. Type locality: Stephansort, Astrolabe Bay, NE Papua New Guinea.

MATERIAL EXAMINED

TYPES: MNHN-B3628, 2 ♀ (34.6 x 27.5; 39.0 x 30.8 mm), New Caledonia, coll. M. Balansa. The larger female corresponds to the measurements given by A. Milne Edwards (1873) and is designated the lectotype.

OTHER MATERIAL: QMW19557, ♀ (31.7 x 25.7 mm), Nggela Is., Solomon Islands, 17.12.1976.

DESCRIPTION

Carapace. c.1.25 times broader than long. Fronto-orbital width c.1.06 times carapace length. Depth c.0.7 times carapace width. Lateral margins slightly convergent posteriorly; sinuous. Anterolateral margins regularly convex; without teeth, but typical position of first tooth slightly indicated. Exorbital angle triangular. Front c.0.45 times carapace width; c.0.54 times fronto-orbital width; lateral angles obtuse; lateral margins diverging posteriorly. Post-frontal lobes distinct; median lobes distinctly broader than laterals; laterals distinctly separated from inner orbital margin. Branchial ridges moderately prominent; first arising from position where last epibranchial tooth should be, relatively long; second arising from near lateral margin.

Posterior margin c.0.45-0.5 times carapace width. Carapace surface smooth, shining, punctate, without marked setation. Upper orbital border smooth; straight and oblique. Lower orbital border straight; evenly granular. Inter-antennular septum moderately narrow, c.0.3 times width of front.

Third maxilliped. Suture between merus and

ischium horizontal. Accurate measurements not possible on dry types.

Chelipeds. Merus with posterior border minutely striated; without distinct subdistal spine; lower border granulate; anterior border coarsely granulate mesially; carpus with inner angle granular; inner margin granular, with a secondary ventral granular ridge bearing tuft of long setae proximally; granules present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm not defined anteriorly by a longitudinal ridge. Outer surface of palm punctate, naked; usually with median longitudinal row. Inner surface of palm with low granular vertical crest and patch of granules ventro-proximally, otherwise smooth. Immovable finger slightly flattened on outer surface; moderately long. Length cutting edge c.0.5 times length propodus. Ventral border of chela straight. Dorsal surface of dactyl tuberculate; on female appear to be 4 or 5 forwardly directed tubercles over proximal three-fifths of inner dorsal margin, largest proximally, evenly spaced, with chitinous tips on distal tubercles - these could be expected to be stronger and more prominent on males. Fingers pointed; curved slightly inwards; narrow gape between cutting margins (probable that males would have larger gape).

Walking legs. Second pair slightly the longest; c.1.6 times maximum carapace width. Merus of third leg c.2.4-2.5 times as long as wide. Carpus c.2.4-2.7 times as long as wide. Propodus c.2.3-2.5 times as long as wide. Dactyli c.0.9-1.0 times length of propodus. Carpi and propodi bear a short felt of setae on anterior surfaces and on ventral faces of first three pairs; restricted to a thin band on anterior surface of fourth pair; felt extends onto and encircles dactyli in 6 thin lines.

COLOUR

Purple, with the borders of the carapace, the chelipeds, and the walking legs becoming reddish (A. Milne Edwards, 1873).

REMARKS

This species is easily distinguished by the lack of strongly defined epibranchial teeth. The first epibranchial tooth is only slightly indicated on the lectotype and paralectotype, is small but visible on the specimen from the Solomon Islands, and is better developed on the holotype of *N. biroi* but still lacks the fissure in the anterolateral margin that is typical of other species. The distinct first epibranchial tooth seems to be the major character that separates *N. biroi* from *N. integrum*, however as there are so few specimens available, and the specimen from the Solomon Islands is intermediate in development I am inclined to believe that this character is subject to some individual variation. Despite the fact that all specimens are female and therefore do not show strong chela features, there seems to be no differences in shape or dentition of the chelae between *N. biroi* and *N. integrum*. Nobili (1905) described the meri of legs 1-3, of *N. biroi*, as having the distal third of their posterior border minutely denticulate, and on the Solomon Islands specimen there are also a few small denticles distally on legs 1 and 2. It is still possible that *N. biroi* will prove to be a valid species, however I do not believe it can be reliably separated from *N. integrum* at this time, and feel that until a good series of male and female specimens are available from several localities, it is best to place it into the synonymy of *N. integrum*.

The holotype of *N. biroi* is a poorly preserved dry female with disarticulated limbs (Forró & Müller, 1985), and therefore it could not be loaned for study. The photographs of the holotype are published here through the kindness of Dr László Forró.

The male is so far not known.

HABITAT

In the mangrove forest (A. Milne Edwards, 1873).

DISTRIBUTION

New Caledonia (type locality of *N. integrum*); Solomon Islands (present record); northern coast of Papua New Guinea (*N. biroi*).

Neosarmatium laeve (A. Milne Edwards, 1869)
(Figs 1A, B; 8; 17)

Sesarma laeve A. Milne Edwards, 1869: 27.

Sesarma laevis: De Man, 1887: 649; 1892: 333 (note on type-specimen in the description of *Sesarma moeschi*).

Sesarma (*Sesarma*) *aequifrons* Rathbun, 1914: 76; Tesch, 1917: 129.

Sesarma (*Sesarma*) *laevis*: Tesch, 1917: 164.

Neosesarma laevis: Serène & Soh, 1970: 395, 405.

Neosesarma aequifrons: Serène & Soh, 1970: 395, 405 (in list).

Neosarmatium aequifrons: Serène, 1977b: 758-59, figs 62-64; Haig, 1984: 127.

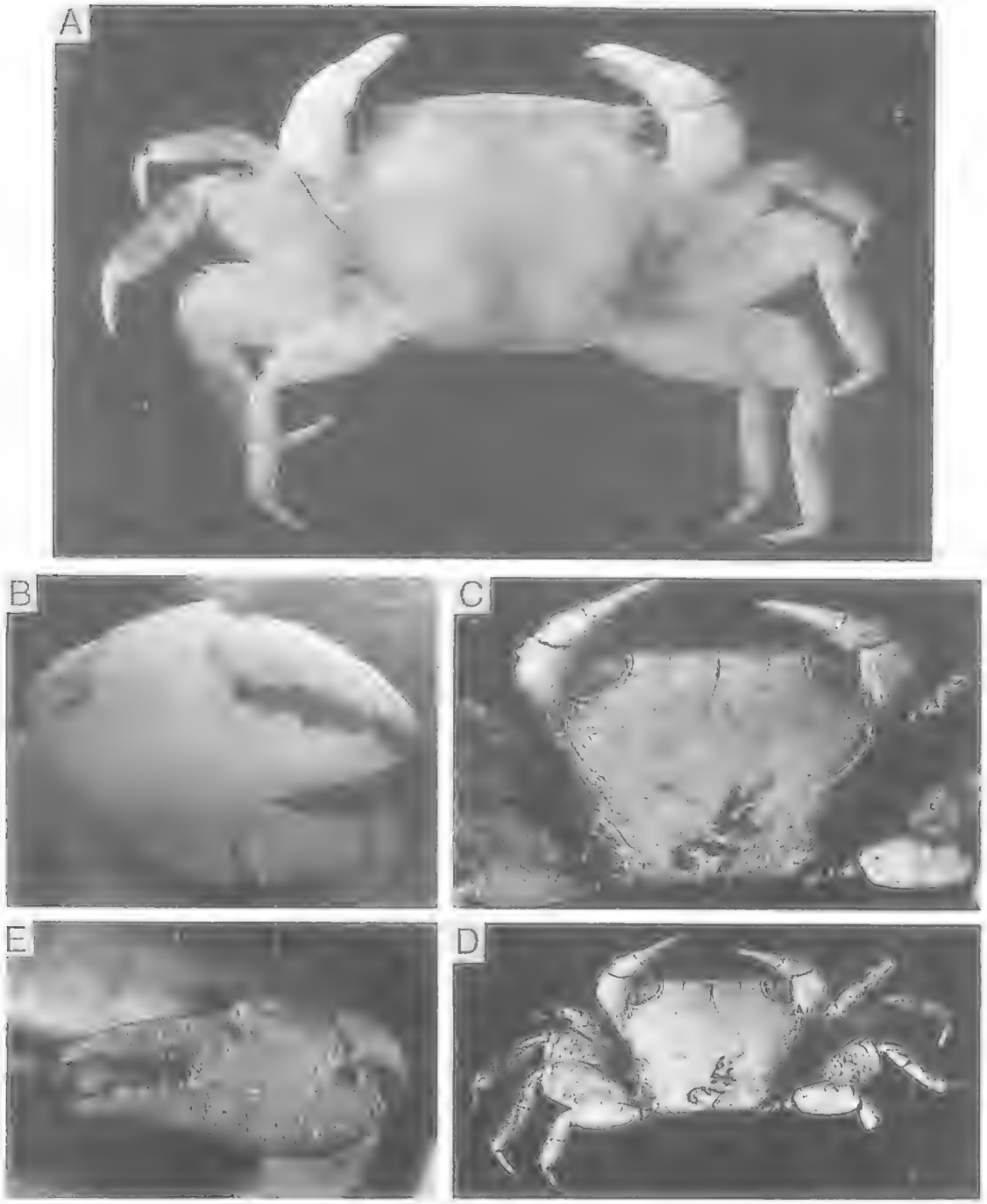

FIG. 8. *Neosarmatium laeve* (A. Milne Edwards, 1869). A, B, holotype of *N. aequifrons* (Rathbun, 1914); C-E, holotype of *N. laeve*. A, C, D, dorsal views; B, right chela; E, left chela.

Neosarmatium ambonensis Serène & Moosa, 1971: 12, pl. 5C, D.

TYPE INFORMATION

N. laeve: holotype, MNHN-3964, Paris. Type locality: Aru Island, southeastern Indonesia.

N. aequifrons: holotype, USNM45754, Washington. Type locality: Pangaman River, Port Colton, Busuanga Island, Philippines.

N. ambonensis: holotype, Institute of Marine Research of Indonesia, Djakarta. Type locality: Ambon, Indonesia.

MATERIAL EXAMINED

USNM45754, *N. aequifrons* holotype ♂ (11.4 x 9.0 mm), paratype ♀ (10.7 x 8.3mm), Pangaman River, Port Colton, Busuanga Island, Philippines, 15.12.1908, U.S. Bureau of Fisheries, Albatross Philippine Expedition of 1907-09; QMW19555, 2 ♂ (10.9 x 8.7; 11.3 x 9.1mm), Nggela Is., Solomon Islands, 17.9.1976.

DIAGNOSIS

(Modified after Serène & Moosa, 1971).

Carapace smooth and punctate, c.1.25 times broader than long. Lateral margins sub-parallel, or slightly convergent; a single prominent epibranchial tooth, second reduced to a trace. Frontal border nearly straight, almost two-thirds carapace width; postfrontal lobes faintly indicated. Posterior border straight and narrower than front. Maximum carapace width across epibranchial teeth. Inner surface of palm of male cheliped with prominent vertical granular crest; outer edge of upper border of palm with finely granular longitudinal rim; superior margin of dactyl with 4 low, distally directed, tubercles; a moderate gape between fingers of mature males. Meri of walking legs broad, anterior borders convex, with acute subdistal spine; short transverse striae; carpi and propodi with dense covering of short setae above lateral accessory carinae. Male abdomen with telson as long as broad at base; segment 6 slightly shorter than telson, and exactly twice as broad (at base) as long.

REMARKS

Although I have not examined the types of *N. ambonensis* and *N. laeve*, I have little doubt of the correctness of the new synonymy presented here. Serène (1977) recognised that *N. ambonensis* and *N. aequifrons* were synonyms. Serène & Soh (1970) had placed *N. aequifrons*, and tentatively, the poorly known *N. laeve*, into their new genus *Neosesarma*. The differences in dentition of the dactyl of the cheliped between *Neosarmatium* and *Neosesarma* are enough however to exclude *N. laeve* from the latter genus. Comparisons of the photographs of the holotypes of *N. aequifrons* (Fig. 8A, B), *N. laeve* (Fig. 8C-E), and *N. ambonensis* (Serène & Moosa, 1971, pl. 5 C, D) show no points of difference. Unfortunately the type of *N. laeve* is immature, and the diagnostic chela characters are not clear; this has no doubt been the cause of its uncertain taxonomic position. The close geographical proximity of the respective type localities further supports the synonymy presented here.

This is one of the smallest of the species of *Neosarmatium*. It is unusual in the genus by being relatively quadrate, with the anterolateral margins not markedly convex, and the carapace being not as deep as in other species. In all other major respects however, their seems no cause to exclude it from the genus. It can be separated from its congenors using the characters presented in the key.

HABITAT

Not recorded.

DISTRIBUTION

From Busuanga Is., in the Philippines, south to Ambon and Aru Islands, in eastern Indonesia; Solomon Islands (present record); and in the Indian Ocean, from Mahé, Seychelles (Serène, 1977b).

Neosarmatium malabaricum (Henderson, 1893)
(Figs 1G, H; 9A, B; 17)

Sesarma indica: Heller, 1865: 64 (in part, the specimens from Ceylon) [Not *Sesarma indicum* H. Milne Edwards, 1837 (= *Tiomanium indicum*)].

Sarmatium indicum malabaricum Henderson, 1893: 393, pl. 36, fig. 17; Tesch, 1917: 220 (no specimen).

Sarmatium punctatum: Thallwitz, 1891: 41, not seen [? = *N. indicum* - not *Metagrapsus punctatus* A. Milne Edwards, 1873 = *Neosarmatium punctatum*].

? *Sarmatium indicum*: Nobili, 1903: 23.

Sesarma (*Sarmatium*) *punctatum*: Pillai, 1951: 37 [? = *N. indicum*].

Neosarmatium indicum malabaricum Serène & Soh, 1970: 398, 405 (in list).

Neosarmatium malabaricum: Serène, 1975: 9-13, pls 1, 2, 3A, B.

TYPE INFORMATION

Lectotype, BMNH1892.7.15.242, designated

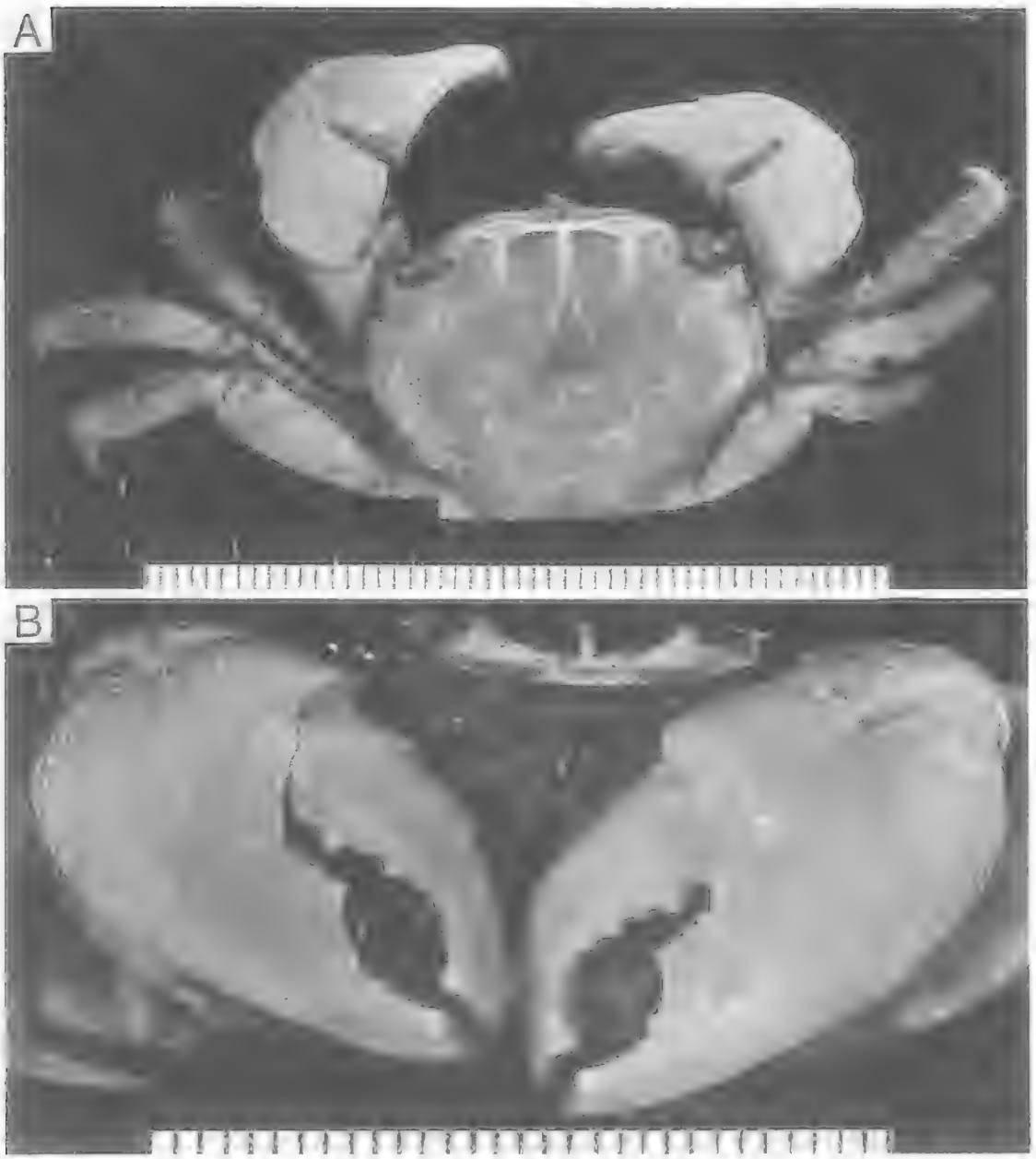

FIG. 9. *Neosarmatium malabaricum* (Henderson, 1893). ♂ syntype, BMNH1892.7.15.242-5. A, dorsal view; B, frontal view. Scale line in mm.

Serène (1975). Type locality: Cochin, Malabar Coast of India.

MATERIAL EXAMINED

MNHN-B10461, 1♂ (22.5 x 19.0mm), mangrove near Pegasus Reef Hotel, Colombo, Sri Lanka, R. Serène, 11.10.1972; MNHN unreg., 6 ♂ (21.5 x 18.1; 22.7 x 18.8; 23.8 x 19.3; 26.2 x 21.5; 29.7 x 24.3; 30.9 x 24.3mm), ♀ (26.7 x 22.0mm), Colombo, Sri Lanka, R. Serène, 12.10.1972.

DESCRIPTION

Carapace. c.1.2 times broader than long. Fronto-orbital width c.1.1 times carapace length. Depth c.0.75 times carapace width. Cardiac region distinct; Lateral margins subparallel;

slightly concave. Exorbital angle triangular and sharp. First anterolateral tooth triangular and blunt; similar in size to exorbital angle. Second anterolateral tooth an angular projection only. Front c.0.6 times fronto-orbital width; strongly vertically deflexed, not visible from above; with shallow median emargination; lateral angles bluntly acute; slight pre-orbital concavity; lateral margins concave. Post-frontal lobes without clumps of setae. Epi-branchial ridges run inwards from each anterolateral tooth; short ridge medially on first epibranchial tooth. Branchial ridges prominent; first follows from posterior edge of last epibranchial tooth; relatively short; others arise just inside lateral margin; a strong ridge curving over base of last leg. Posterior margin c.0.45 times carapace width. Carapace surface smooth, shining, punctate. Setae arranged sparsely on branchial lines. Upper orbital border smooth to microscopically granular. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.36 times width of front.

Third maxilliped. Suture between merus and ischium horizontal. Ischium inner margin smooth. Exopod narrow, not much visible in frontal view; 0.4-0.5 times width of ischium.

Chelipeds. Merus with posterior border with minute granular striations; lower border granulate; anterior border convex coarsely granulate; carpus with inner angle granular; inner margin unarmed; a secondary ventral granular ridge bearing a short row of long setae proximally; tubercles present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm defined anteriorly by a swollen longitudinal ridge; posteriorly by uneven granular rim with some larger granules distally. Outer surface of palm naked, punctate proximoventrally, with short oblique granular striations; with indistinct median longitudinal row. Inner surface of palm sparsely granular; with a strongly raised granular vertical crest, and a secondary, lower, oblique granular crest running onto base of fixed finger. Immovable finger rounded on outer surface; moderately long, length cutting edge c.0.47 times length propodus. Ventral border of chela straight below fixed finger. Dorsal surface of dactyl bearing 2 large, acute, chitinous tipped tubercles on superior inner margin, similar size and shape, one medial, one proximal. Fingers pointed, lower finger with tip notched, such that dactyl is intermeshing; curved slightly inwards; a wide gape between cutting margins.

Walking legs. First three pairs all of similar length, second slightly the longer, c.1.6 times maximum carapace width. Merus of third leg c.2.1 times as long as wide. Carpus c.2.1 times as long as wide. Propodus c.1.7 times as long as wide. Dactyli about equal to length of propodi, or slightly longer than propodi. Carpi and propodi bear a short felt of setae on both dorsal and ventral surfaces of legs 1-3, above the accessory carinae on the carpi and almost encircling the propodi distally; this felt only on dorsal surface of fourth leg; felt continues in thin rows onto the dactyli.

Male abdomen. Width segment 3 c.4 times length. Segment 6 slightly elongated, c.1.6 times wider than long. Telson subequal to segment 6, both longer than preceding segments; c.1.1 times longer than wide; evenly rounded.

Gonopods. G1 relatively slender. Inner-dorsal margin distally curved inward. Dorsal surface of stem flattened; completely calcified. Palp poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem straight. Distal part of the stem narrow. Apical process corneous, strongly produced, straight. Gonopore terminal. Setae long, simple, lie along apical process and on palp obscuring structural detail. G2 short; evenly curved, twisted.

Colour

'Live specimens are dark brown with a violet tinge, especially on the carapace' (Pillai, 1951: 371).

Remarks

The present specimen was compared with photographs of the holotype in the British Museum. They are identical. See remarks under *N. indicum* for discussion of points of separation from that species and from *N. punctatum*.

Habitat

Serène (1975) noted that in Sri Lanka it is similar to *N. meinerti* in that it lives in the rearward mangrove zone around the houses, and in the grass platform around the coconut trees; also they dig deep holes but do not construct mounds. Pinto (1984) observed that it was crepuscular, colonised the drier soils, and made T-shaped burrows which bifurcate shortly after their origin. Around the Vembanad Lake, in Southern India, Pillai (1951, as *Sesarma punctatum*) said that it shows a preference for muddy regions where it burrows in loose dark mud close to the waterline.

Distribution

Cochin, Malabar Coast, India (type locality);

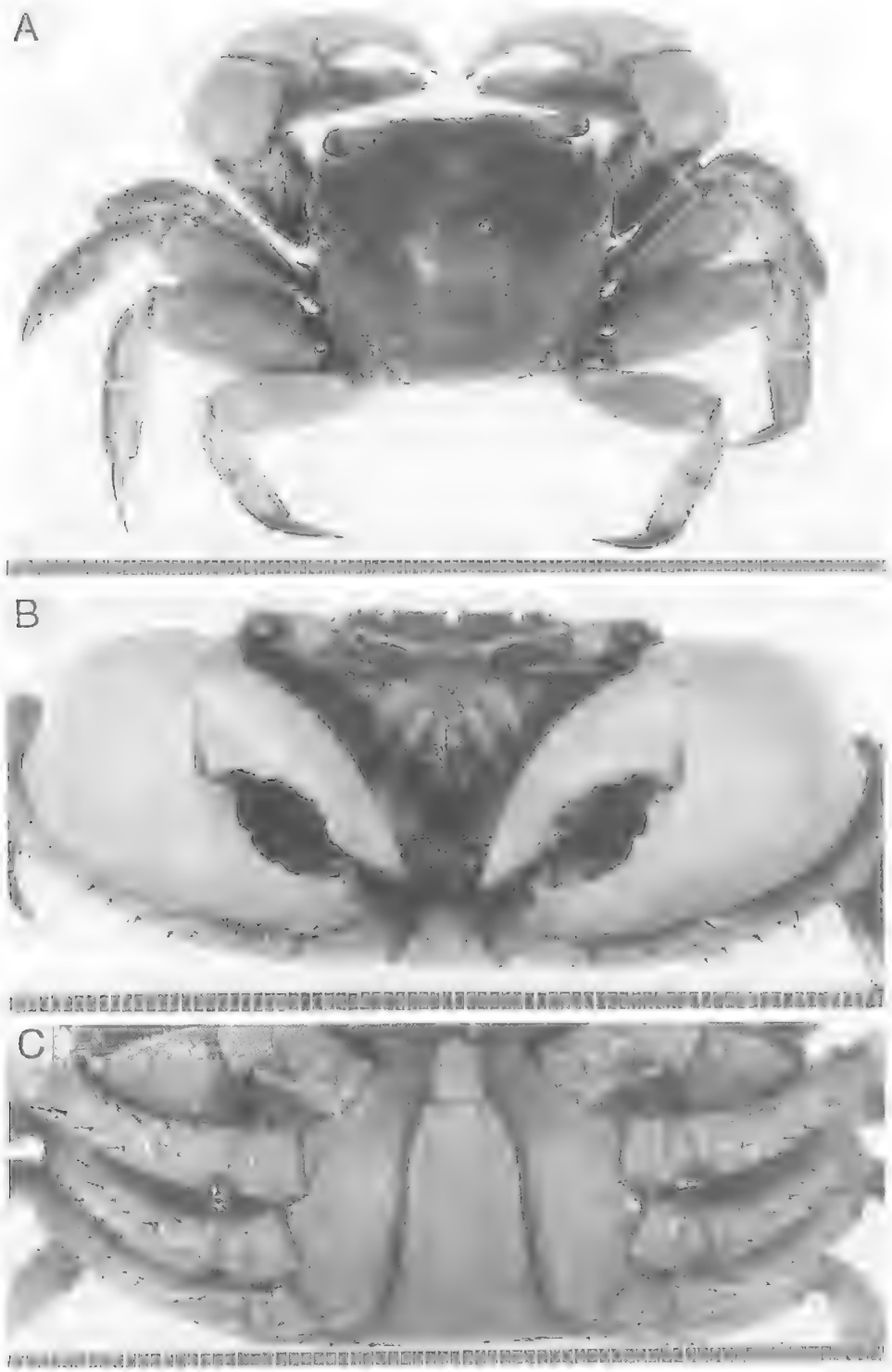

FIG. 10. *Neosarmatium meinerti* (De Man, 1887), ♂, AMP11213. A, dorsal view; B, frontal view; C, ventral view of abdomen and sternum. Scale line in mm.

Ceylon (Serène 1975; and present record). Also almost certainly from the Vembanad Lake, Southern India (Pillai, 1951); Seychelles (Nobili, 1903); Nicobars (Heller, 1865).

Neosarmatium meinerti (De Man, 1887)
(Figs 2E-G; 10; 16)

Sesarma tetragona: H. Milne Edwards, 1837: 73; 1853; 184-185; Krauss, 1843: 44; Hilgendorf, 1869: 90, pl. 3, fig. 3d; 1879: 809; A. Milne Edwards, 1868a: 71; Hoffmann, 1874: 23; Lenz & Richters, 1881: 425; Henderson, 1893: 392 [not *Cancer tetragona* Fabricius, 1798: 341].

Sesarma africana?: Bianconi, 1869: 341 [fide Hilgendorf, 1879. 809; Tesch, 1917: 171].

Sesarma tetragonum: Miers, 1879: 490; Stebbing, 1910: 321; 1917a: 438; 1917b: 10.

Sesarma rotundifrons: De Man, 1880: 24 [not *Sesarma rotundifrons* A. Milne Edwards, 1869].

Sesarma meinerti De Man, 1887: 648, 668-69; Pfeffer, 1889: 31; Bürger, 1893: 617; Ortmann, 1894a: 720; 1894b: 56; Alcock, 1900: 417; Doflein, 1904: 130; Lenz, 1905: 372; Gravier, 1920: 472; Cott, 1930: 679-92, pl. 1; Horikawa, 1940: 30; Lin, 1949: 30; Fourmanoir, 1953: 89; 1954: 5; Haig, 1984: 127.

Sesarma (Sesarma) meinerti: Tesch, 1917: 171-174, 246; Chace, 1942: 201; 1953: 441; Miyake, 1938: 108; Barnard, 1950: 125-26, fig. 25e-f; Crosnier, 1965: 61, figs 81, 90, 91, 96, 103.

Sesarma (Episesarma) meinerti: De Man, 1895: 166.

Sesarma (Sarmatium) meinerti: De Man, 1929, fig. 4 (in part).

Neosarmatium meinerti: Serène & Soh, 1970: 398, 406 (in list); Serène, 1973: 127-129, pl. 4 A-C; 1977a: 51; Dai et al., 1986: 496, fig. 280, pl. 70(3); Dai & Yang, 1991: 543-44, fig. 280, pl. 70(3)

Type Information

Holotype unidentifiable (see Remarks). Type locality: Isle de France (= Mauritius).

Material Examined

SOUTH AFRICA: QMW8835, 3♂ (41.3 x 35.7; 42.2 x 36.2; 45.7 x 39.0mm), 1♀ (30.5 x 25.6mm), 7.5.1964, W. Macnae; QMW8877, 2♂ (46.7 x 38.1; 37.5 x 32.7mm), 7,8.1964, W. Macnae; QMW8878, 5♂, 3♀ (27.0 x 22.2 - 42.3 x 35.7mm), South Africa, 7.8.1964, W. Macnae. MADAGASCAR: MNHN-B16735, 2♂ (42.8 x 34.8; 40.2 x 33.4mm), 3 ovig. ♀ (34.4 x 28.9; 37.9 x 31.4; 38.9 x 32.3mm), Nosy-Be, A. Crosnier. MAURITIUS: NNM17503, ♂ (27.1 x 22.4mm), Fort Barkly, Port Louis, Mauritius, C. Michel, Feb. 1960. AUSTRALIA: ZMH Unreg., 2♂ (35.0 x 29.0; 39.5 x 33.3mm), Crab Creek, 14 miles east of Broome, W. Australia, G. Hartman, 11.9.1975; AMP11213, ♂ (38.2 x 32.7mm), ♀ (40.2 x 33.2mm), Melville Bay and Cape Arnhem area, NT, no date or collector information; QMW9077, ♂ (46.2 x 37.9mm), Nungbalgarri Ck., 10 km upstream Rolling Bay, NT, 11°59'S, 133°59'E, Aug. 1975, D. Grace, *Ceriops* forest, mudfloor, caught in pipe trap; QMW9076, ♂ (45.2 x 38.5mm), Ngandauda Ck., Boucaut Bay, NT, 12°05'S, 134°43'E, 8.9.1975, D. Grace, 20.5 kms upstream, west bank, *Avicennia* forest, mudfloor, burrows; QMW9074, ♂ (42.9 x 36.1mm), Hutchinson Strait, Buckingham Bay, NT, 12°15'S, 135°19'E, 24,Sep.1975, D. Grace, upper reaches Ck. A., *Ceriops* thicket, burrows; QMW9075, 2♀ (47.5 x 39.6; 39.8 x 33.3mm), Glyde R., Buckingham Bay, NT, 12°17'S, 135°02'E, 14.9.1975, D. Grace, 5 kms upstream, east bank *Avicennial/Ceriops* mudfloor, burrows; QMW9072, 2♂ (43.0 x 37.2; 44.0 x 37.0mm), Glyde River, Buckingham Bay, NT, 12°S, 135°E, 12.9.1975, D. Grace, 15 kms upstream, west bank, *Avicennial/Ceriops* mudfloor, burrows; QMW9073, ♀ (43.3 x 35.5mm), Glyde River, Buckingham Bay, NT, 12°21'S, 135°02'E, 14.9.1975, D. Grace, 30 km upstream, east bank, *Brugiera/Ceriops* forest, burrows; QMW8837, ♂ (48.4 x 41.6mm), Buckingham River, NT, 12°31'S, 135°43'E, 29.9.1975, burrow in mud-bank below *Ceriops*; QMW8836, ♂ (44.9 x 38.4mm), Mornington Island, NT, 16°36'S, 139°21'E, Dec. 1976, J. Covacevich; NTM Unreg., ♂ (38.4mm c.b.), Stn HC/4, MacArthur R., Gulf of Carpentaria, R. Hanley; NTM Cr Unreg., ♀ (40.0mm c.b.), Stn PC/T5, MacArthur R., Gulf of Carpentaria, R. Hanley.

Diagnosis

Carapace smooth, shining, punctate, bearing short setae in tufts; c.1.2 (1.5-1.23) times broader than long. Lateral margins slightly convergent posteriorly; a single prominent epibranchial tooth, second tooth present but reduced to a trace; greatest carapace width between middle of first epibranchial teeth. Frontal border slightly sinuous with a shallow median concavity, approximately half carapace width; postfrontal lobes strongly indicated. Posterior border straight; width variable, usually less than frontal width in males, but may be subequal or wider in females. Merus of cheliped without subdistal tooth developed on posterior margin. Inner surface of palm of male cheliped with a vertical crest consisting of a single row of large tubercles; outer surface without sub-median, horizontal crest; outer edge of upper border of palm without obvious longitudinal rim; ventral border of chela broadly convex; superior margin of dactyl with a single row of uniform sized, evenly spaced,

chitinous tubercles; a broad gape between fingers of mature males. Meri of walking legs broad (merus of third pair c.2.5 times longer than wide), anterior borders slightly convex, with acute subdistal spine, dorsal face with short transverse striae; carpi and propodi with dense covering of short setae around superior margin. Male abdomen narrow; telson slightly longer than broad at base; segment 6 elongated, c.1.6 times longer than telson, and c.1.1 times broader (at base) than long.

Colour

'*S. meinerti* is an extremely handsome beast. Above, the carapace is dark purple anteriorly, passing into a beautiful deep violet posteriorly, and having the anterior and lateral margins narrowly bordered with orange; the under surfaces are mauve and ochre. The walking legs are purple dorsally, with an orange spot around the hinge-like articulations between the joints, and pale yellow beneath. ... The proximal joints [of the chelipeds] are pale yellow, the merus bright orange, the wide and conspicuous carpus and the proximal region of the propodus and dactylus being a brilliant red, intermediate in tone between vermilion and orange. Beneath the chelipeds are yellow' (Cott, 1930: 682-83).

It appears that the intensity and predominant colour of this species changes through its range. In the Northern Territory, Australia, I have found two colour morphs living sympatrically. The 'orange form' has predominantly orange chelipeds, with the palm being orange over the proximal half, fading to yellow distally, the fingers being mainly yellow; the carapace has a reddish-orange undertone, and reddish-orange anterolateral margins. The 'yellow form' has the chelipeds a uniform dirty pale yellow; the carapace is steel-gray but with a yellowish undertone, the yellow being predominant on the anterolateral margin.

Remarks

De Man named this species without seeing specimens. He realised that the record of *Sesarma tetragona* of H. Milne Edwards (1853) from Isle de France, was wrongly identified and represented an undescribed taxon. Unfortunately there is now no indication in the collections of the MNHN, Paris, which specimens had been examined by H. Milne Edwards, or even if they still exist (D. Guinot, in litt.). One bottle containing three females (MNHN-B 10887) is labelled 'Sesarma Meinerti de Man vu par M. de Man, 10 juin 1890 Ile de France'; but this is after De Man had published his new name, and there is no other indication that this was the H. Milne Edwards' material. I have considered designating a neotype, however there is currently no confusion over the identity of *N. meinerti*, and the stability of nomenclature is not threatened. Under these circumstances according to Article 75(b) of the *International Code of Zoological Nomenclature* (Third Edition, 1985) the designation of a neotype would be invalid.

This is probably the best known and best studied of the *Neosarmatium* species, and along with *N. smithi*, the most widely distributed. Early reports recorded this species from the south-western Pacific, from eastern Australia and New Caledonia, but Serène (1973) realised that these specimens differed in a number of consistent features from typical *N. meinerti* and described a new species *N. fourmanoiri* to accept them. The characters that separate these two species are given under 'Remarks' for *N. fourmanoiri*.

Habitat and Biology

Cott (1930) and Hogue & Bright (1971) have written accounts of the ecology and natural history of *N. meinerti* in South Africa and Kenya respectively. 'Lives on the higher and drier ground adjoining the mangrove ditches ... a low lying area covered with coarse grass and intersected by tidal mangrove creeks, and being about 6-8 feet above the mud level of the ditches' (Cott, 1930; 680). Bright & Hogue (1972; 7) record 'Sandy-clay areas and higher, drier, muddy banks associated with estuaries and mangroves'. In the Northern Territory it lives in the rearward-most mangrove zone, a very dry area, inundated by high spring tides only.

'Burrows are well developed and most common in areas where there is dry, relatively hard mud. The burrows are deep and usually extend to the water table. Often the mouth of the burrow has a hood built of mud excavated while enlarging the tunnel or cleaning out. These crabs are retiring, remaining at the mouth of the burrow, and only leave to forage at night. They apparently feed primarily on plant material, but also act as scavengers where they occur in high density. There is no indication of colonialism in areas of high density' (Bright & Hogue, 1972: 7-8).

Larval stages have been described by Pereyra Lago (1989). There are five larval stages and development takes an average of 25 days at 25°C and in 35 ppt. salinity.

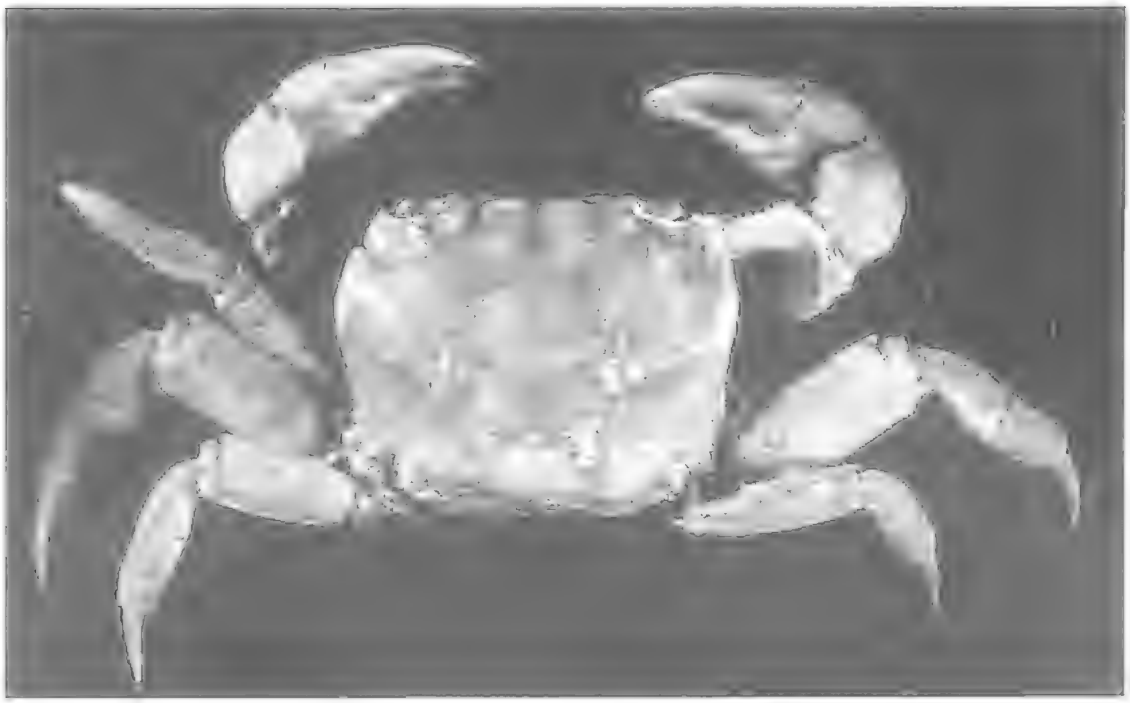

FIG. 11. *Neosarmatium punctatum* (A. Milne Edwards, 1873). Dorsal view of ♂ holotype.

DISTRIBUTION

Only key references given. Mauritius (type locality, H. Milne Edwards, 1853); Madagascar (Crosnier, 1965); South Africa (Barnard, 1955); Aldabra (Haig, 1984); Seychelles (Serène, 1977a); East Africa (A. Milne Edwards, 1868; Ortmann, 1894); India (Alcock, 1900); Andamans (Alcock, 1900); Indonesia (De Man, 1895); northwestern Australia, and the Gulf of Carpentaria (present records); Philippines (Bürger, 1893); Saipan, Marianas, Micronesia (Miyake, 1938); Taiwan (Horikawa, 1940; Lin, 1949; Dai & Yang, 1991).

Neosarmatium punctatum (A. Milne Edwards, 1873)
(Figs 11; 17)

Metagrapsus punctatus A. Milne Edwards, 1873: 308, pl. 17, fig. 2.

Sarmatium punctatum: De Man, 1887: 660 (no new specimens).

? *Sarmatium punctatum*: Urita, 1926: 20; Sakai, 1934: 325 [? = *N. indicum*].

TYPE INFORMATION

Lectotype (here designated), ♂ (31.0 x 24.6 mm), MNHN-B3630. Type locality: New Caledonia.

MATERIAL EXAMINED

SYNTYPES: MNHN-B3630, 1♀ (30.8 x 23.0mm) 2♂ (31.0 x 24.6; 35.4 x 26.3mm), New Caledonia, M. Balansa, no date.

OTHER MATERIAL: QMW19897, ♂ (28.9 x 22.6mm), in garden at Anse Vata, Noumea, C. Henin, Feb. 1993.

DESCRIPTION

Carapace. c.1.25-1.35 times broader than long. Fronto-orbital width c.1.05-1.1 times carapace length. Depth c.0.7 times carapace width. Cardiac region distinct. Lateral margins slightly convergent posteriorly; sinuous. Anterolateral margins with single, forwardly directed, epibranchial tooth, triangular and blunt; similar in size to exorbital angle; with second small epibranchial projection. Exorbital angle triangular and sharp. Front c.0.5 times carapace width; c.0.6 times fronto-orbital width; lateral angles bluntly acute; small pre-orbital concavity present; lateral margins concave. Lateral post-frontal lobes distinctly but narrowly separated from orbital margin. Post-frontal lobes without clumps of setae. Single sharp lateral ridge running from obliquely behind last anterolateral tooth to outer edge of posterior

margin; first branchial ridge follows from posterior edge of epibranchial projection, relatively long; second arising from just short of lateral margin; third arising from lateral margin. Posterior margin c.0.5 times carapace width. Carapace surface smooth and shining, punctate; wrinkled posteriorly; without obvious setation. Upper orbital border smooth, but minutely granular laterally. Lower orbital border straight; evenly granular. Basal segment of antennal peduncle with outer tongue short, bearing thick fringe of setae on ventral edge. Inter-antennular septum c.0.4 times width of front.

Third maxilliped. Suture between merus and ischium sloping slightly obliquely inward. Exopod narrow, not obvious in frontal view, reaches slightly less than half length of merus.

Chelipeds. Merus with posterior border minutely granulate; with blunt projection; lower border granulate; anterior border tuberculate mesially and proximally, convex; carpus with inner angle granular; inner margin granular, with secondary ventral, microscopically granular ridge bearing tuft of long setae proximally; granules present on inner face of carpus just below inner angle; outer margin striated. Upper surface of palm defined anteriorly by an indistinct longitudinal ridge. Outer surface of palm naked, punctate, granular medio-ventrally; with median longitudinal row. Inner surface of palm mainly smooth; with strongly raised granular vertical crest and with short row of 3–4 large granules obliquely at base of fixed finger. Immovable finger slightly flattened on outer surface; moderately long. Length cutting edge c.0.45 times length propodus. Ventral border of chela convex. Dorsal surface of dactyl smooth, rounded, but bearing 2 strong blunt spines on inner margin, proximal one smaller, c.one-fifth length from base, distal one larger and placed just short of halfway; tipped with chitin; female chela with spines less prominent. Fingers pointed, but with narrow spooning; curved inwards; a wide gape between cutting margins.

Walking legs. Third pair slightly the longest, c.1.4 times maximum carapace width. Merus of third leg c.2.2 times as long as wide. Carpus c.2.1-2.3 times as long as wide. Propodus c.1.9-2 times as long as wide. Dactyli c.0.9-1.0 times length of propodus. Dactyli stout and slightly recurved. Carpi and propodi bear a short felt of setae on both dorsal and ventral surfaces of legs 1-3, above the accessory carinae on the carpi, and almost encircling the propodi distally; only on dorsal surface of 4th leg; felt continues in thick rows onto the dactyli; also present on extreme distal end of upper margin of meri of legs 1–4 and on sub-distal spine.

Male abdomen. Male abdomen moderately broad; segment 1 the widest (segments 1-3 subequal). Segment 1 covers entire width of sternum between 4th pereiopods; narrow. Segments 3-5 tapering (tapering strongly from 3-4, then moderately). Width segment 3 c.4.4 times length. Segment 6 elongated (moderately); 1.6 times wider than long. Telson not longer than preceding segments (sub-equal to segment 6); 1.1 times longer than wide; evenly rounded.

Gonopods. Could not be extracted from dry type specimens, and abdomen and gonopods missing from spirit specimen.

Colour

'Sa couleur est d'un violet foncé devenant rougeatre sur les pattes' (A. Milne Edwards, 1873: 309).

Remarks

All three type specimens must be considered syntypes, but as the smaller male, 31.0 x 24.6mm, corresponds to the size of the only specimen mentioned by A. Milne Edwards (1873) it is here designated as the lectotype; the other two specimens become paralectotypes.

The only records for this species which can be relied on at this time are those of the type series and one recent specimen from New Caledonia. Otherwise the records must be considered to be confused between *N. punctatum* and its very closely related sister-species *N. malabaricum* from the eastern Indian Ocean. Henderson (1893) erected *Sarmatium malabaricum* as a subspecies of *N. indicum* after being told by A. Milne Edwards that his specimens were referable to *S. indicum* not *S. punctatum* as Henderson had at first supposed. It is clear that while Milne Edwards was correct in realising that Henderson's specimens were not *S. punctatum*, he erred in thinking they were like *S. indicum*. The present examination of the type material of *N. punctatum* with specimens of *N. malabaricum* from Ceylon, and photographs of the lectotype (designated by Serène, 1975), reveal that the species are extremely close. They can only be separated by: 1, on *malabaricum* the distal tooth on the upper surface of the dactyl of the cheliped is placed very close to the middle; while on *N. punctatum* it is clearly less than half way to the tip; 2, the upper surface of the palm of the cheliped has a very strong longitudinal rim marking its outer edge on

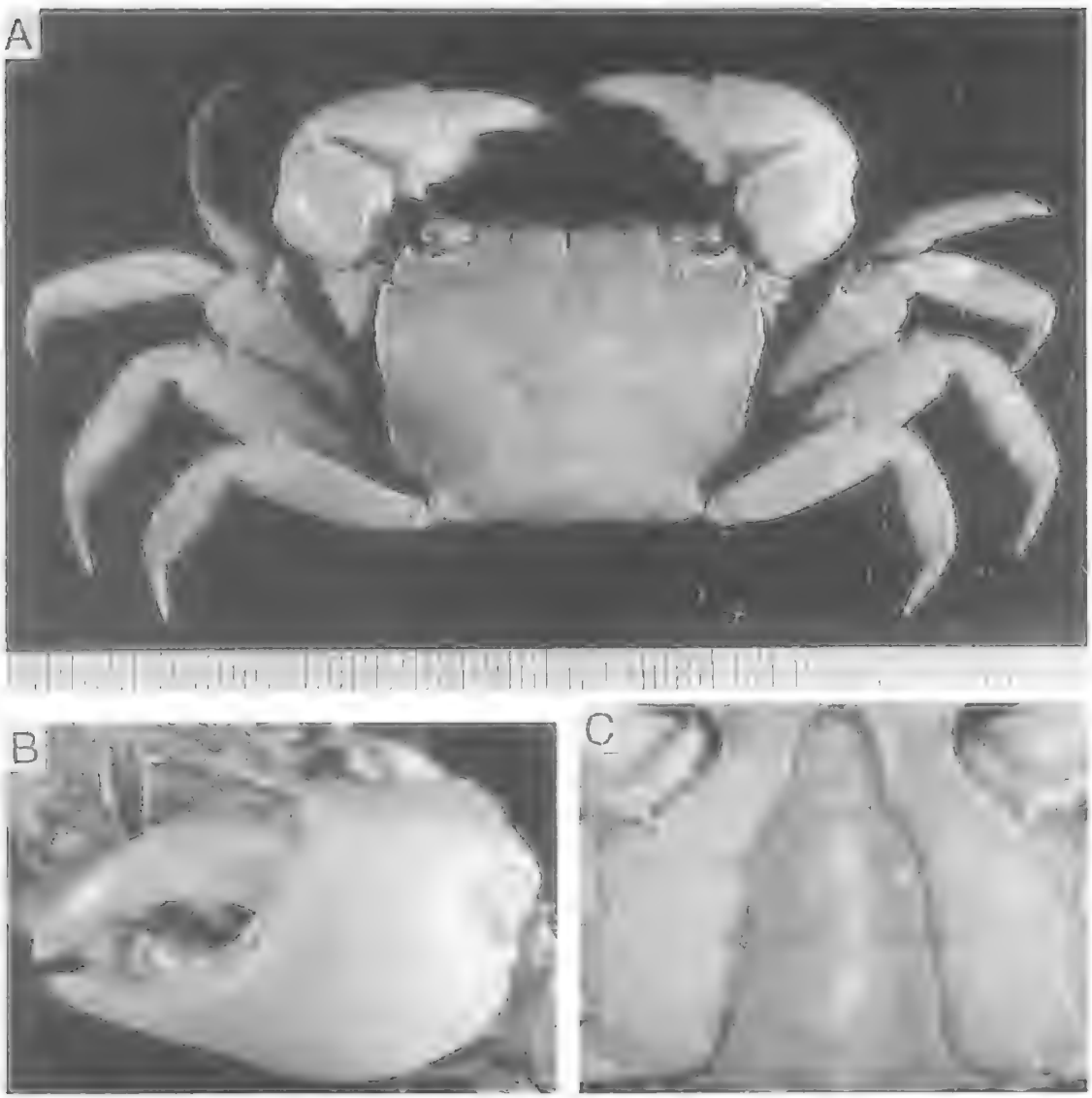

FIG. 12. *Neosarmatium rotundifrons* (A. Milne Edwards, 1869), ♂ holotype of *N. fryatti* (Tesch, 1917). A, dorsal view; B, chela; C, abdomen and sternum. Scale line in mm.

malabaricum, but this rim is much less distinct on *punctatum*; 3, *N. malabaricum* is c.1.16-1.22 times broader than long, compared with 1.26-1.35 for the type series of *N. punctatum*. This last character is usually quite conservative within other species of this genus and is independent of size except for very small specimens.

These two species are very similar but I believe the differences are significant enough to maintain them as separate species. It is also interesting to note that these two species also conform to the pattern of some other *Neosarmatium* and *Sarmatium* species of having closely related sister species in the south-western Pacific Ocean e.g. *N. meinerti* and *N. fourmanoiri*; *N. smithi* and *N. trispinosum* sp. nov. (see Figs 16, 18). The distributional boundaries and/or overlap zones between *N. malabaricum* and *N. punctatum* still remain to be properly resolved.

Henderson (1893) used a number of characters to separate *S. malabaricum* from specimens of *S. punctatum* in the British Museum which had been

collected from the Indo-Malayan region and earlier identified by E.J. Miers. It is clear however that Miers also had misidentified his material and that they were really specimens of *S. indicum* that Henderson was comparing with his specimens. Serène (1975) similarly thought that the specimens from Indo-Malaya that he and Tweedie had seen in the Zoological Reference Collection, Singapore, were *S. punctatum* whereas in fact they too are *N. indicum*. This is why he erroneously restated the differences already listed by Henderson to separate *N. malabaricum* from *N. punctatum*.

HABITAT

Habitat information was not recorded for the type specimens; the most recent example was collected dead from a garden in Anse Vata, a suburb of Noumea.

DISTRIBUTION

Only definitely known from the type locality, New Caledonia. Possible records from Indonesia, and Japan, more likely refer to *N. indicum*.

Neosarmatium rotundifrons (A. Milne Edwards, 1869)
(Figs 2A, B; 12; 18)

Sesarma rotundifrons A. Milne Edwards, 1869: 30; De Man, 1887: 648 (no specimen); Tesch, 1917: 198, 230, 246 (no specimen).

Sesarma (Sarmatium) rotundifrons: De Man, 1929: 111, fig. 3, 4a, 4b.

Sarmatium fryatti Tesch, 1917: 216-220, figs 6-8.

Sesarma meinerti: De Man, 1887: 648, 668-69, in part, (fide De Man, 1929).

? *Sesarma* (*Episesarma*) *meinerti*: De Man, 1895: 166 (in part: three females only).

Neosarmatium rotundifrons: Serène & Soh, 1970: 398: 406 (in list).

TYPE INFORMATION

N. rotundifrons: holotype, ZMH-K4195. Type locality: Upolu, Samoa.

N. fryatti: holotype, NNM-1955. Type locality: Nias, off the western coast of Sumatera, Indonesia.

MATERIAL EXAMINED

HOLOTYPE: ZMH-K4195, ♀ (34.3 x 27.1mm), Upolu, Samoa (Museum Godefroy No. 2361).

OTHER MATERIAL: Holotype of *S. fryatti*, NNM-1955, ♂ (32.6 x 25.3mm), Nias, E.E.W. Schröder, 1908.

DIAGNOSIS

Carapace smooth and shining, finely pitted, bearing short setae in small tufts; c.1.2-1.3 times broader than long. Lateral margins sinuous; a single prominent epibranchial tooth, second tooth present but reduced to a trace; greatest carapace width across second epibranchial teeth. Frontal border strongly sinuous with a deep median concavity, less than half (c.0.45) carapace width; postfrontal lobes strongly indicated. Posterior border straight, width subequal to front. Merus of cheliped without subdistal tooth developed on posterior margin. Inner surface of palm of male cheliped with prominent vertical granular crest; outer surface with short, prominent, sub-median, transverse crest; outer edge of upper border of palm without obvious longitudinal rim; superior margin of dactyl with 4-5 distally directed spines, evenly spaced over the proximal half; a broad gape between fingers of mature males. Meri of walking legs broad (merus of third pair c.2.5 times longer than wide), anterior borders only slightly convex, with acute subdistal spine, dorsal face with short transverse striae; carpi and propodi with dense covering of short setae around superior margin. Male abdomen narrow; telson slightly longer than broad at base; segment 6 longer than telson, and c.1.3 times broader (at base) than long

REMARKS

De Man (1929) compared the type material of *Sarmatium fryatti* with the holotype of *Sesarma rotundifrons* and was the first to establish that these two species were synonymous. I have also re-examined the two holotypes and agree with De Man. When Tesch described *S. fryatti* in 1917, he had not seen specimens of *Sesarma rotundifrons* A. Milne Edwards, and it had still not at that time been figured. He believed it to belong to *Sesarma* (*Sesarma*) not to *Sarmatium*, and for this reason he failed to compare it with his new species of *Sarmatium* which he naturally thought to be undescribed. The type of *N. fryatti* is used here to illustrate the male morphology of *N. rotundifrons* for the first time.

DISTRIBUTION

Upolu, Samoa (A. Milne Edwards, 1869); Indonesia: Nias, off west coast of Sumatera; Java; Obi Is., Moluccas (Tesch, 1917, as *N. fryatti*)

Neosarmatium smithi (H. Milne Edwards, 1853)
(Figs 2J, K; 13; 18)

Sesarma smithi H. Milne Edwards, 1853: 187; Hoffmann, 1874: 24; De Man, 1887: 652-653; Bürger, 1893: 618, pl. 21, fig. 2; Ortmann, 1894b: 722; Haig, 1984: 128.

Sesarma smithii: H. Milne Edwards, 1854: 149, pl. 9, fig. 2; A. Milne Edwards, 1868a: 71; De Man, 1880: 29; Kingsley, 1880: 217.

Sesarma (Sesarma) smithi: Rathbun, 1910: 328; Miyake, 1936: 497, pl. 35, figs 1, 2; Sakai, 1939: 686.

Sesarma (Sesarma) smithii; Tesch, 1917: 199-200; Barnard, 1950: 124; Crosnier, 1965 [in part]: 59, pl. 4, fig. 2 [not figs 74, 79, 86, 102 = ? *N. trispinosum*].

Sesarma (Sarmatium) smithii; Tweedie, 1936: 68.

Sesarma oceanica: Chhapgar, 1957: 58, pl. 16, figs d-g [not *S. oceanica* De Man, 1889 = *Pseudosesarma rotundatum*].

Neosarmatium smithi: Serène & Soh, 1970: 398, 405, pl. 5A, B; Sakai, 1976: 665-666, text-fig. 364; Hirata et al. 1988: 26, colour plate; Dai *et al.*, 1986: 496, fig. 279(3), pl. 70(2); Dai & Yang, 1991: 543, fig. 279(3), pl. 70(2).

Type Information

Holotype, MNHN-B3962. Type locality: Port Natal, South Africa.

Material Examined

Holotype: MNHN-B3962, ♀ (37.1 x 33.1mm), Port Natal, South Africa.

Other Material: SOUTH AFRICA: QMW8861, 2♂ (30.0 x 27.9; 36.2 x 34.0mm), ♀ (35.8 x 33.3mm), Inhaca Island, Aug. 1963, W. Macnae. MADAGASCAR: MNHN-B16764, ♀ (29.6 x 27.8mm), Nosy Bé, A. Crosnier, c.1964. ZANZIBAR: MNHN-B3685, ♂ (dry), (35.6 x 32.6mm), M. Grandidier. MALAYSIA: QMW8865, ♂ (37.3 x 3.0mm), Kuala Selangor, A. Sasekumar, 1979. PHILIPPINES: NNM32716, ♀, Maribago, Mactan Island, near Cebu, coll. Gomez, 1979; ZMG628, 5♀ (29.0 - 32.8mm), 4♂ (25.8 - 30.0mm), Manila, Luzon, 3°24'N, 101°12'E, C. Semper, April 1860 - Nov. 1861.

Description

Carapace. c.1.1 times broader than long. Fronto-orbital width c.0.95 times carapace length. Depth c.0.8-0.85 times carapace width. Lateral margins slightly convergent posteriorly; sinuous. Anterolateral margins with two forwardly directed teeth behind the exorbital angle; exorbital angle sharp and outer margin straight; first anterolateral tooth triangular; larger than exorbital angle; second anterolateral tooth blunt, minute but obvious. Front c.0.45 times carapace width; c.0.5- 0.6 times fronto-orbital width; lateral margins slightly concave, lateral angles obtuse. Postfrontal lobes distinct, laterals c.half width of medians, poorly separated from orbit. Branchial ridges prominent; first follows from posterior edge of last epibranchial tooth; relatively long; second arising from lateral margin; third arising from, or just short of, lateral margin. Posterior margin c.0.45 times carapace width. Carapace surface smooth, shining, punctate; setae in short tufts on anterior half and posteriorly in rows along branchial lines. Upper orbital border evenly, finely, granular; oblique, slightly sinuous; inner angle rounded. Lower orbital border straight; evenly granular. Inner orbital tooth minutely granular. Inter-antennular septum c.0.3 times width of front.

Third maxilliped. Suture between merus and ischium horizontal. Ischium sub-triangular; inner margin smooth. Exopod narrow, not much visible in frontal view, reaching about half length of merus; c.0.4 times width of ischium.

Chelipeds. Merus with posterior border minutely granulate and faintly striated; with distinct subdistal spine; lower border minutely granulate; anterior border with small granules or tubercles mesially on outer edge of lip; carpus with inner angle armed with a few sharp granules; inner margin unarmed except for a row of granules, and a tuft of long setae proximally on secondary ventral ridge of inner margin; granules present on inner face of carpus just below inner angle; outer margin with granular striations. Upper surface of palm defined anteriorly by a swollen longitudinal ridge. Outer surface of palm naked; with a median longitudinal row. Inner surface of palm smooth except for strongly raised granular vertical crest continuing obliquely for about two-thirds of fixed finger. Immovable finger slightly flattened on outer surface; moderately long. Length cutting edge c.0.5 times length propodus. Ventral border of chela slightly convex, coarsely granular posterior to fixed finger. Dorsal surface of dactyl bearing a small blunt proximal tubercle on inner edge, followed by a large, truncate, chitinous tooth, followed by a smaller tooth of similar form, all three evenly separated over proximal half; otherwise smooth.

Walking legs. Second and third pairs sub-equal and longer than others. Longest leg c.1.7 times maximum carapace width. Merus of third leg c.2.2-2.5 times as long as wide. Carpus c.2.3-2.5

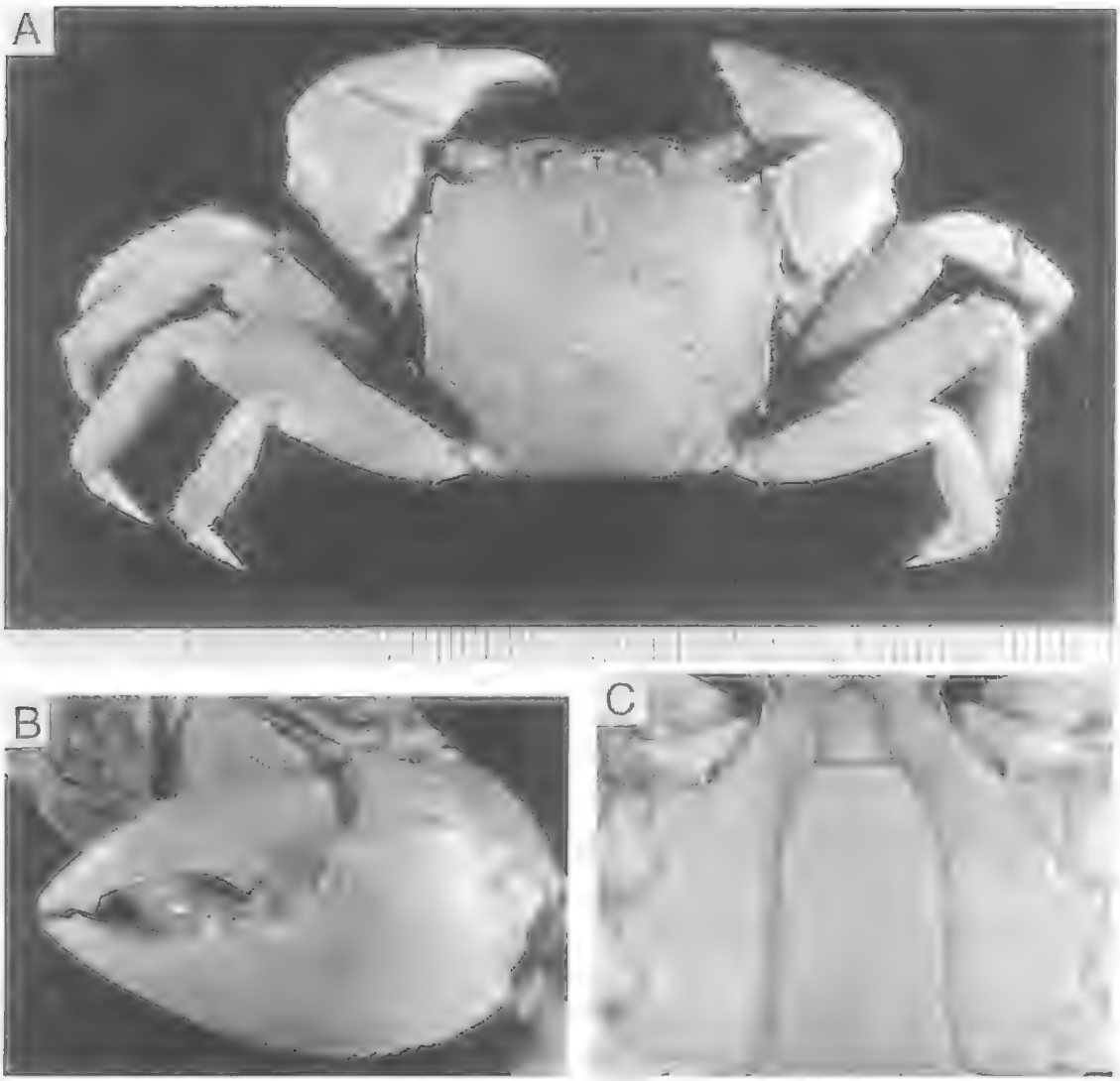

FIG. 13. *Neosarmatium smithi* (H. Milne Edwards, 1853), ♂, QMW8861. A, dorsal view; B, chela; C, abdomen and sternum. Scale line in mm.

times as long as wide. Propodus c.2.2-2.4 times as long as wide. Dactyli c.0.8-0.9 times length of propodus.

Male abdomen. Width segment 3 c.3.2-4.0 times length. Segment 6 elongated, longest, length and width subequal. Telson not longer than preceding segments, sub-equal to segment 5; 1.3-1.5 times longer than wide; evenly rounded.

Gonopods. G1 inner-dorsal margin straight. Dorsal surface of stem flattened, concave; completely calcified. Palp present, poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem convex. Distal part of the stem narrow. Apical process present, corneous, strongly produced, straight. Gonopore terminal. Setae present, short, simple, lie around corneous tip and apical part of stem obscuring structural detail. G2 short, evenly tapering, slightly twisted, apically rounded.

COLOUR

Dorsal carapace, legs, and merus and carpus of chelipeds, dark purple; outer face of chela and fingers bright red, but with dark dorsal dactylar teeth.

REMARKS

This widespread species has been wrongly identified in the south-western Pacific region, where it is replaced by a sister species *Neosarmatium trispinosum* sp. nov. In part, this has been caused by the fact that the holotype is a female, and the arrangement of the spines on the superior border of the dactyl of the cheliped is unclear. On *N. smithi* the dorsal surface of dactyl bears a small blunt proximal tubercle on the inner edge, followed by a large, truncate, chitinous tooth, and then a smaller tooth of similar form, all three evenly separated over proximal half. On *N. trispinosum* however, there are also three teeth but they take the form of large, acute, conical, chitinous spines, set close together in proximal two-fifths, the smallest being near the articulation as in *N. smithi*, but it is the third, most distal tooth, that is the largest. Even though these spines are vestigial in the female, traces of them can be found on careful examination, and therefore this is still a good character for discriminating between the species using a specimen of either sex.

Ecological studies referring to this species by Giddins et al. (1986), Neilson et al. (1986), Neilson & Richards (1989) are all actually referring to *N. trispinosum* sp. nov.

HABITAT

Mangroves (Rathbun, 1910; Crosnier, 1965). Pinto (1984) noted that they live in complex burrows that have the entrance protruding above the soil surface as a hollow cylinder reinforced by mangrove roots; they actively built these 'castles' after rains when the burrows were flooded. He found them to be mainly nocturnal.

DISTRIBUTION

Southern Africa and Madagascar - Port Natal (H. Milne Edwards, 1853); Nossi-Faly (near Madagascar) (De Man, 1880); Madagascar (Crosnier, 1965); Aldabra (Haig, 1984). India - Bombay (Chhapgar, 1957 as *Sesarma oceanica*). Sri Lanka (Pinto, 1984). S.E. Asia - Lem Ngob, Thailand (Rathbun, 1910); Singapore (Tweedie, 1936); Malaysia, Philippines (present records); Hainan Is., China (Dai & Yang, 1991); extending as far north as Okinawa, Ryukyu, Japan (Sakai, 1976; Hirata et al., 1988).

Neosarmatium trispinosum sp. nov.
(Figs 2H, I; 14; 18)

Sesarma smithii: A. Milne Edwards, 1873: 305; De Man, 1889: 426; 1890: 94; McCulloch, 1913: 322.
Sesarma (Episesarma) smithi: Nobili, 1899: 267.
Sesarma (Neosarmatium) sp.: Davie, 1982: 207.

MATERIAL EXAMINED

HOLOTYPE: QMW5143, ♂ (31.3 x 29.2mm), Serpentine Ck, Moreton Bay, SE.QLD, 27°24'S, 153°07.0 E, mangroves, on sandy substrate, 11.8.1972, B. Campbell.

PARATYPES: MNHN unreg. ♂ (41.2 x 36.4mm), New Caledonia. [♂ pleopod figured]; QMW19556, 3 ♀ (22.9 x 20.2; 30.8 x 28.3; 39.0 x 35.1mm), mangroves at Pam, northern New Caledonia, 27.2.1992, J-L. Menou; SMF1987, 2♂ (38.5 x 36.4; 42.3 x 38.6mm), Fiji; NNM743, ♀ (24.7 x 21.7mm), ♂ (24.8 x 21.9mm), Omgeuire Base G, Hollandia, New Guinea, G. Van Hout; MNHN unreg. (Serène colln), ♂ (31.6 x 28.4mm), Vanuatu, R. Serène, 10.10.1971; SMF unreg., ♀ (31.2 x 26.9mm), ♂ (34.6 x 31.6mm), Cape Ferguson, near A.I.M.S., south of Townsville, NE. QLD, mangroves, M. Türkay, 11.6.1980; QMW9137, ♂ (25.9 x 3.2 mm), Annie River, NE.QLD, 14°25'S, 143°34'E, 20.5.1973, B. Campbell, small creek near jetty (Loc 4); QMW8864, ♂ (31.5 x 28.2mm), Endeavour River, Cooktown, NE.QLD, 15°28'S, 145°15'E; QMW8876, ♂ (16.4 x 14.2mm), Barron River, near Cairns, NE.QLD, 16°52'S, 145°42'E; QMW8872, ♂ (36.1 x 33.8mm), Cairns, NE.QLD, 16°55'S, 145°46'E, 5.3.1962; QMW8875, ♂ (13.3 x 11.7mm), Johnstone R., nr Flying Fish Point, nr Innisfail, NE.QLD, 17°3'S, 146°05'E; QMW8866, ♂ (28.7 x 25.9mm), on road to Lucinda (near Ingham), NE.QLD, 18°32'S, 146°2'E, 20.3.1962, W. MacNae; QMW8871, ♂ (33.7 x 31.0mm), Ross Creek, Townsville, NE.QLD, 19°16'S, 146°49'E; QMW8869, ♀ (27.9 x 24.6mm), South Townsville Inlet, NE.QLD, 19°17'S, 146°5'E; QMW8976, 2 ♀ (31.0 x 28.6; 32.2 x 28.8mm), 2 ♂ (31.7 x 28.8; 31.9 x 29.8mm), Chunda Bay, Hinchinbrook Island, off Townsville, NE.QLD, 19°17'S, 147°03'E, I. Knipp; QMW8870, ♂ (32.7 x 29.7mm), Bassett Creek, Mackay, ME.QLD, 21°09'S, 149°11'E; QMW8838, ♂ (34.4 x 31.6mm), Deepwater Bend, South Pine River, SE.QLD, 27°2'S, 153°E, 1.3.1950, G. Davis; QMW8839, ♂ (30.3 x 27.5mm), Deepwater Bend, South Pine River, SE.QLD, 27°2'S, 153°E, 26.3.1950, G. Davis; QMW8862, ♂ (33.6 x 30.5mm), Fishermen Island, Brisbane River, SE.QLD, 27°23'S, 153°1'E, Nov. 1964, B. Campbell; QMW8863, ♂ (34.0 x 30.5mm), Brisbane River, SE.QLD, 27°23'S, 153°1'E, 1964, B. Campbell; QMW8867, ♂ (34.4 x 30.7mm), Fisherman Island, Brisbane River, SE.QLD, 27°23'S, 153°1'E, Nov. 1964, B. Campbell; QMW8868, ♂ (33.3 x 30.3mm), Fisherman Island, Brisbane River, SE.QLD, 27°23'S, 153°1'E; QMW8873, ♀ (31.2 x 28.0mm), Fisherman Island, Brisbane River, SE.QLD,

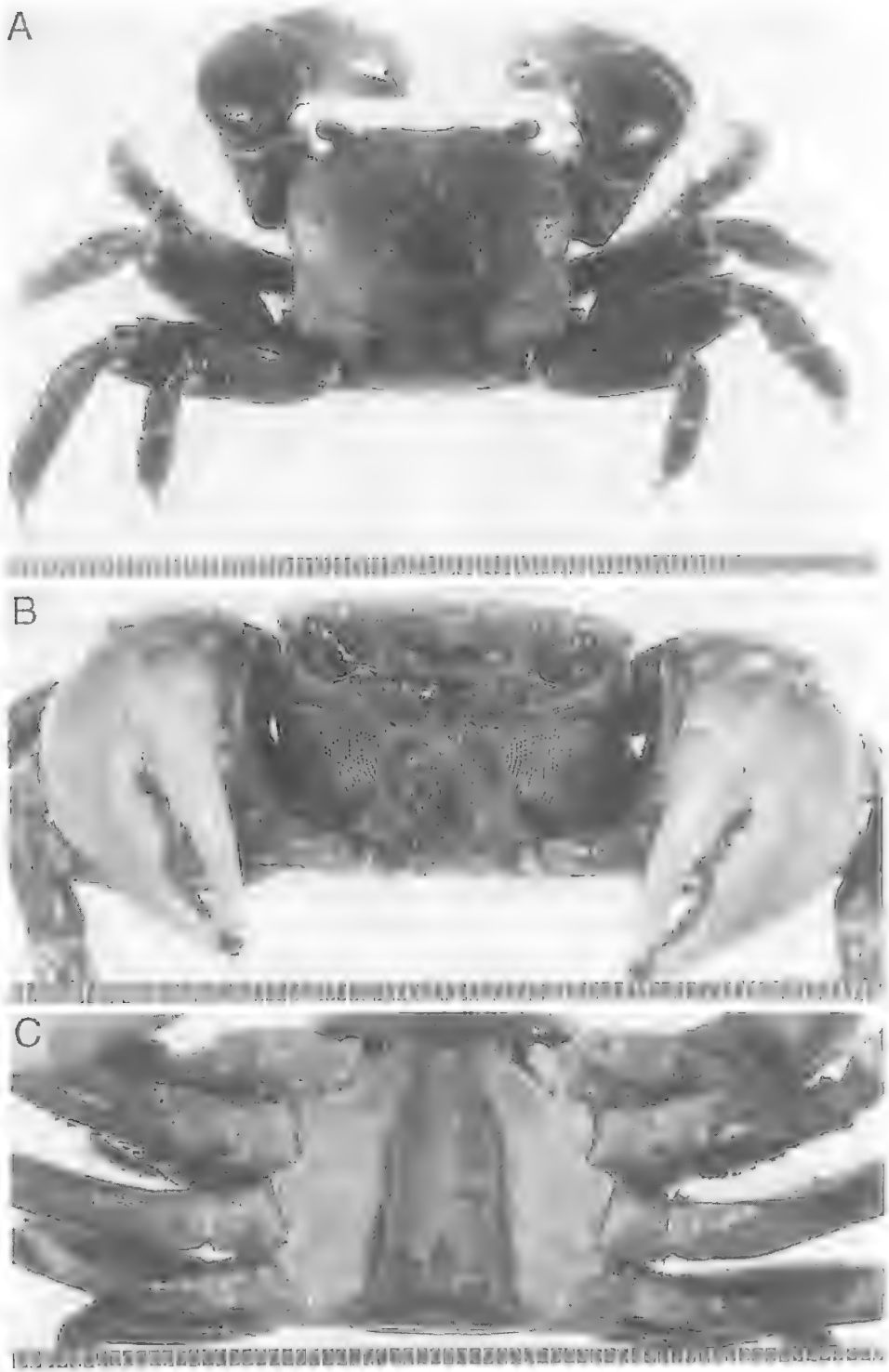

FIG. 14. *Neosarmatium trispinosum* sp. nov., ♂ holotype ,QMW5143. A, dorsal view; B, frontal view; C, ventral view. Scale line in mm.

27°23'S, 153°1'E; QMW8874, ♀ (22.8 x 20.7mm), Fisherman Island, Brisbane River, SE.QLD, 27°23'S, 153°1'E, 16.10.1958, B. Campbell, large (75mm) burrows in mud, H.W.S.

OTHER MATERIAL: MNHN-B16763, ♂ (33.6 x 30.4mm), label states 'Provenance inconnue'.

DESCRIPTION

Carapace. c.1.1 times broader than long. Fronto-orbital width c.0.95 times carapace length. Depth c.0.8 times carapace width. Cardiac region indistinct. Lateral margins slightly convergent posteriorly; sinuous. Anterolateral margins with two forwardly directed teeth behind the exorbital angle. Exorbital angle sharp and outer margin straight. First anterolateral tooth blunt; larger than exorbital angle. Second anterolateral tooth minute, blunt. Front c.0.45 times carapace width; c.0.55 times fronto-orbital width; lateral angles obtuse; with slight, small, pre-orbital concavity; lateral margins slightly concave. Lateral postfrontal lobes very narrow, not as swollen as medians. Branchial ridges prominent; first follows from posterior edge of last epibranchial tooth; relatively long; second arising from lateral margin; third arising from, or just short of, lateral margin. Posterior margin c.0.45 times carapace width. Carapace surface smooth, shining, punctate. Setae in short tufts on anterior half and posteriorly in rows along branchial lines. Upper orbital border evenly finely granular. Lower orbital border straight; evenly granular. Inter-antennular septum c.0.3 times width of front.

Third maxilliped. Suture between merus and ischium horizontal. Ischium sub-triangular; inner margin smooth. Exopod narrow, not much visible in frontal view, reaching about a half length of merus; c.0.3 times width of ischium.

Chelipeds. Merus with posterior border minutely granulate and faintly striated; with distinct, small, subdistal spine; lower border granulate; anterior border smooth; carpus with inner angle slightly produced, armed with a few sharp granules; inner margin unarmed, a tuft of long setae proximally on secondary ventral ridge of inner margin; granules present on inner face of carpus just below inner angle; outer margin with sparse granular striations. Upper surface of palm defined anteriorly by swollen longitudinal ridge. Outer surface of palm, naked, punctate; with median longitudinal row. Inner surface of palm mainly smooth; with a strongly raised granular vertical crest, continuing obliquely for about 2/3 of fixed finger. Immovable finger slightly flattened on outer surface; moderately long; length cutting edge c.0.5 times length propodus. Ventral border of chela slightly convex; coarsely granular posterior to fixed finger. Dorsal surface of dactyl bearing 3 large acute chitinous spines set close together in proximal two-fifths, forwardly directed, conical, smallest near articulation, largest distally; otherwise smooth. Fingers pointed; curved slightly inwards; a wide gape between cutting margins.

Walking legs. Second pair slightly the longest, c.1.6 times maximum carapace width. Merus of third leg c.2.3 times as long as wide. Carpus c.2.5 times as long as wide. Propodus c.2.2 times as long as wide. Dactyli c.0.9 times length of propodus. Short setae in fringing rows and on accessory carinae.

Male abdomen. Segment 1 c.0.95 times width segment 3. Width segment 3 c.3.6 times length. Segment 6 the longest, length and width subequal. Telson c.1.3 times longer than wide; evenly rounded.

Gonopods. G1 inner-dorsal margin straight. Dorsal surface of stem concave; completely calcified. Palp present, poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem convex. Distal part of stem narrow. Apical process corneous, strongly produced, straight. Gonopore terminal. Setae present, short, simple; lie around corneous tip and apical part of stem obscuring structural detail. G2 short, evenly tapering, slightly twisted, apically rounded.

COLOUR

Dorsal carapace, legs, and merus and carpus of chelipeds, dark reddish chocolate; outer face of chela and fingers bright red, but with fingers becoming creamy yellow distally.

REMARKS

The closest relative of this species is *Neosarmatium smithi* (H. Milne Edwards), with which it has been wrongly identified in the past. The most distinctive feature distinguishing *N. trispinosum* from *N. smithi* is the shape and arrangement of spines on the dactyl of the male cheliped (as discussed under *N. smithi*). On *N. trispinosum* the three spines are acute, and placed close together in the proximal two-thirds; whereas in *N. smithi* they are truncate, and spaced out over the proximal half.

The label of the male specimen MNHN-B16763, states 'Provenance inconnue'. This was the specimen that was illustrated by Crosnier (1965: figs 74, 79, 86, 102) as representing a

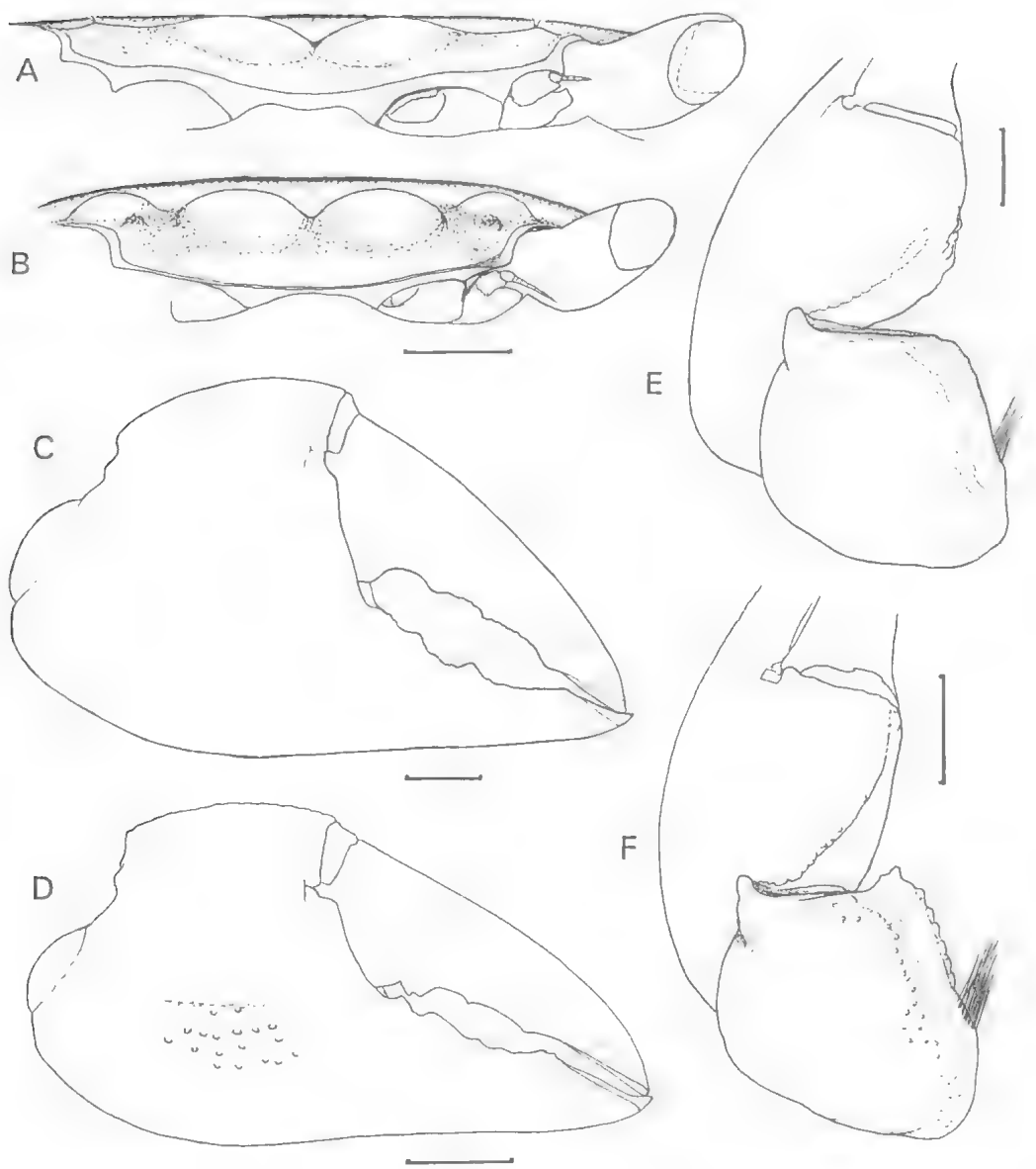

FIG. 15. A, C, E, *Neosarmatium inerme* (De Man, 1887), ♂, ZMH-K4080 (18.5 mm c.b.); B, D, F, *Neosarmatium spinicarpus* sp. nov., holotype. A, B, Frontal view showing shape and size of postfrontal lobes; C, D, right chela, frontal view; E, F, dorsal view of carpus and palm. Scale line = 2mm

Madagascan specimen of *Neosarmatium smithi* (A. Crosnier pers. comm.). It is extremely close to *N. trispinosum* sp. nov. and I consider it to be an abberant specimen of this species which has simply lost the smallest, most proximal spine on the dactyl of the cheliped. It is more than likely that the species was collected in New Caledonia, or in nearby French controlled territories in the Western Pacific.

HABITAT

Neosarmatium trispinosum builds large char-

acteristic mounds at the entrance to its burrow. In southeast Queensland it occurs from the mid- to upper-intertidal zones, amongst *Avicennia* and *Ceriops*. Around Townsville, north Queensland, '*Neosarmatium smithi* [= *N. trispinosum*] ... is the dominant crustacean in the *Ceriops tagal australis* zone of mangroves ... 3.1 m above chart datum, and is infrequently immersed. The crab emerges from its burrow at night to remove litter from the surface of the mud...' (Giddins et al., 1986: 147). This species is a major leaf consumer, with vegetable matter comprising over 90% of its diet; it carries leaves into its burrow where they are allowed to age and decay prior to consumption (Giddins et al., 1986; Neilson et al., 1986; Neilson & Richards, 1989).

DISTRIBUTION

From the Brisbane River north to the Annie River, Cape York, in eastern Australia; New Caledonia (A. Milne Edwards, 1873); Vanuatu (present record); New Guinea (Nobili, 1899 & present record); Fiji (De Man, 1889).

Neosarmatium spinicarpus sp. nov.
(Figs 15B, D, F; 16)

Sesarma (Sarmatium) inermis: Tweedie, 1940: 109; 1950b: 353.

MATERIAL EXAMINED

HOLOTYPE: ZRC1964.9.3.500, ♂ (15.0 x 12.3mm), Stambak, Saribas, Sarawak, Borneo, L.K. Charles, 1952.

PARATYPE: ZRC1964.9.3.501, ♂ (17.4 x 14.4mm), data as for holotype.

OTHER MATERIAL: ZRC1964.9.3.502, ♂ (10.5 x 8.6mm), Kuching, Sarawak, Borneo, M.W.F. Tweedie, 1950; ZRC1964.9.3.504, ♂ (9.7 x 8.2mm) Sedili River, Johore, Malaysia, M.W.F. Tweedie, 1950.

DIAGNOSIS

This species is extremely similar to *N. inerme* with which it agrees in overall description and appearance, except for the following differences. 1, inner angle of carpus of cheliped marked by acute granular projection (cf. Fig. 15E, F). 2, outer medioventral portion of palm of cheliped with slightly more prominent transverse ridge and more prominent rounded granules below it (cf. Fig. 15C, D). 3, inner face of palm with cluster of rounded granules behind base of fixed finger, but not extending as vertical granular row behind gape as on *N. inerme*. 4, cutting margin of fixed finger bears two uneven granular teeth proximally, the inner-most (on very edge of joint) is lacking in *N. inerme* (cf. Fig. 15C, D). 5, median frontal lobes of carapace are considerably more swollen, and separated by a broad U-shaped channel; lateral lobes are subacute, topped with a few small granules, and followed posteriorly by a swollen lobe. In *N. inerme* the median lobes are low, and close together, being separated by a shallow V-shaped incision; the lateral lobes are low and smooth, topped with 1-2 stiff, short setae, and not followed posteriorly by an obvious swelling (cf. Fig. 15A, B).

REMARKS

Neither of the type specimens have fully mature chelipeds i.e. there is not yet a significant gape formed, and the fingers are relatively slender, both of which are characteristics of young males. The degree of granulation and the prominence of the inner angle of the carpus are characters that can vary with maturity, however the largest male was larger than comparative specimens of the closely related *N. inerme* and the large series of specimens of *N. inerme* were very consistent in the characters that I have used to separate the new species. No clear differences however could be seen in the male gonopods. The two smaller males examined, one from Sarawak and one from Johore, Malaysia, do not have a strongly acute projection on the inner angle of the carpus, and have very little granulation generally, but they still have very undeveloped chelae. They are considered too juvenile to identify with certainty as either *N. inerme* or *N. spinicarpus*, and therefore are excluded from the type series, and the record from Malaysia should be considered tentative.

HABITAT

Tweedie (1940: 109) recorded what is probably this species (under the name *Sesarma inermis*) 'from among nipah palms beside the river Sedili.'

DISTRIBUTION

Known with certainty only from Sarawak; probable records from Malaysia (see Remarks).

ACKNOWLEDGEMENTS

I am indebted to Dr Alain Crosnier of ORSTOM for obtaining funding for me to undertake this study, and for his encouragement; and the Board of Trustees of the Queensland Museum for support and travel assistance. A large part of the work was undertaken while at the Laboratoire de Zoologie (Arthropodes), Muséum national d'-

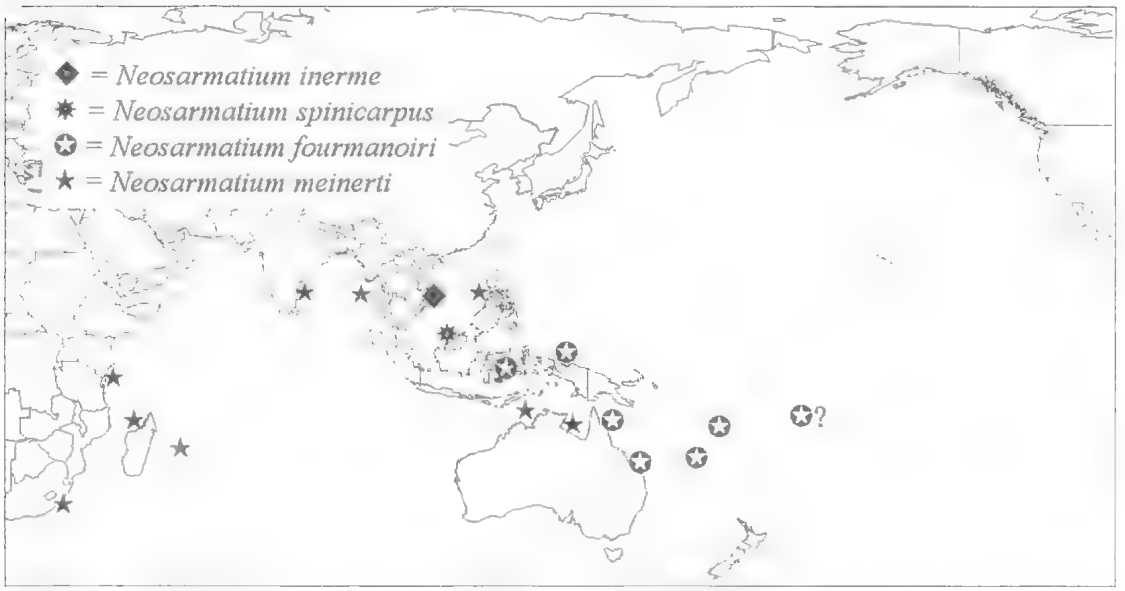

FIG. 16. Map showing the distribution of *Neosarmatium inerme, N. spinicarpus, N. fourmanoiri* and *N. meinerti*. Symbols are intended to show the major distribution records, and therefore it has not been attempted to show every confirmed record, especially when these are closely adjacent.

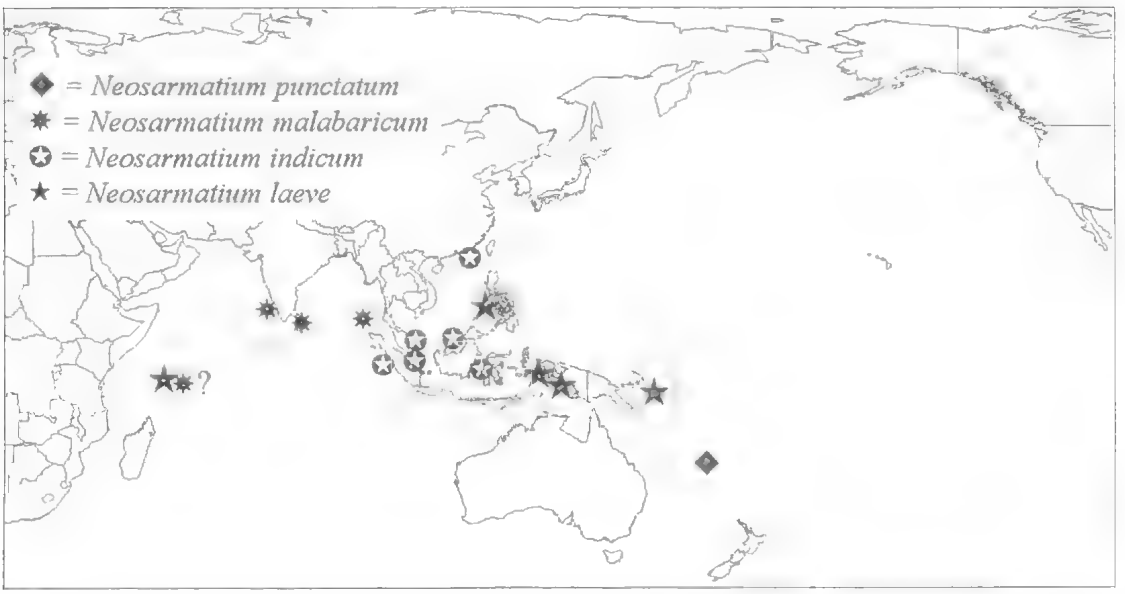

FIG. 17. Map showing the distribution of *Neosarmatium punctatum*, *N. malabaricum*, *N. indicum* and *N. laeve*.

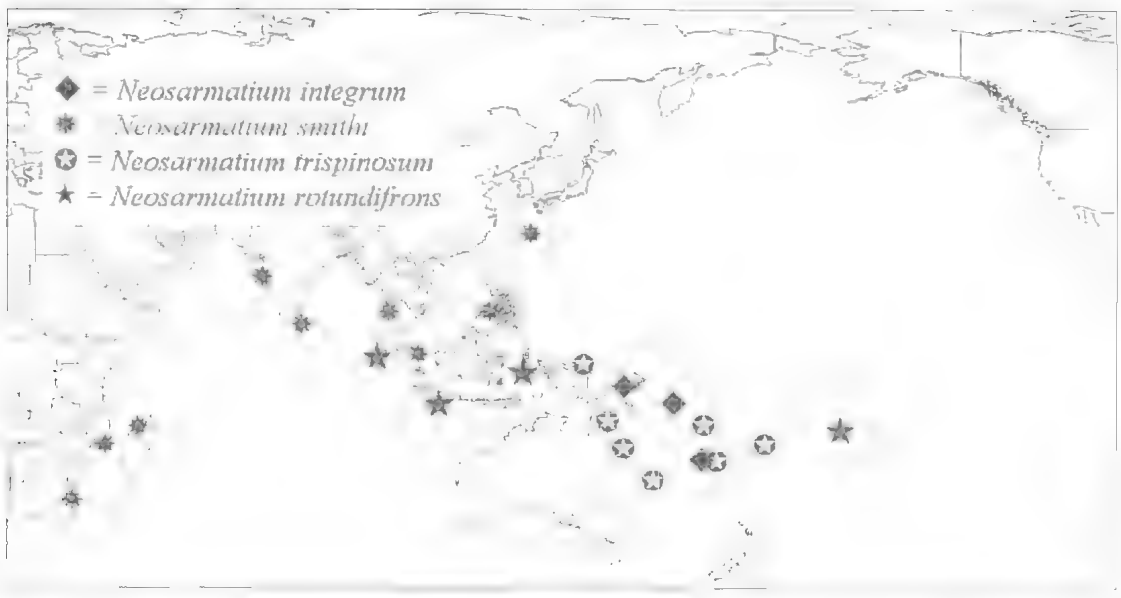

FIG. 18. Map showing the distribution of *Neosarmatium integrum*, *N. smithi*, *N. trispinosum* and *N. rotundifrons*.

Histoire Naturelle, Paris, under a grant from the Institut française de Recherche Scientifique pour le Développement en Coopération (ORSTOM). Dr Danièle Guinot kindly arranged the loan of comparative specimens, and searched the MNHN for the type of *N. meinerti*. Dr Charles Fransen of the Nationaal Natuurhistorisch Museum, Leiden, and Dr Michael Türkay of the Forschungsinstitut Senckenberg, Frankfurt, and Mrs C.M. Yang of the Zoological Reference Collection, National University of Singapore, are all sincerely thanked for their generosity and kindness whilst I was visiting their laboratories and for the loan of specimens. Dr László Forró of the Hungarian Natural History Museum, Budapest, very graciously sent me negatives of *N. biroi*. John Short of the QM, and Jacques Rebière of the MNHN, Paris, are thanked for their assistance with photography and help with preparation of plates. M. Maurice Gaillard executed the excellent illustrations of male gonopods. Bob Domrow again graciously advised me on nomenclatural matters. Ray Manning of the USNM, and Peter Ng of the University of Singapore, refereed the manuscript and their careful reading and suggestions have greatly improved the final version. I thank finally my wife Kathleen for her loving support and practical assistance with compiling the manuscript.

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THE HUNTSMAN SPIDERS *HETEROPODA* LATREILLE AND *YIINTHI* GEN.NOV. (ARANEAE : HETEROPODIDAE) IN AUSTRALIA

VALERIE TODD DAVIES

Davies V. Todd, 1994 06 01: The huntsman spiders *Heteropoda* Latreille and *Yiinthi* gen.nov. (Araneae : Heteropodidae) in Australia. *Memoirs of the Queensland Museum* 35(1): 75-122. Brisbane. ISSN 0079-8835.

Thirty-eight *Heteropoda* species are described, thirty-two for the first time. Cosmopolitan *H. venatoria* (Linnaeus) is described briefly and figured. Where possible the others are placed in one of five species groups. In order of description the *procera* group contains *H. procera* (L. Koch), *H. longipes* (L. Koch) and *H. binnaburra* sp.nov. *H. gordonensis* sp.nov. is unassigned to a group. The *bellendenker* group includes new species, *H. bellendenker* and *H. mossman*. The *jugulans* group comprises *H. jugulans* (L. Koch) and the following new species, *H. alta*, *H. hillerae*, *H. cooki*, *H. nagarigoon*, *H. holoventris*, *H. vespersa*, *H. warrumbungle*, *H. distincta*, *H. eungella* and *H. conwayensis*. The *cervina* group comprises new species *H. monroei*, *H. goonaneman*, *H. spurgeon*, *H. bulburin*, *H. acuta*, *H. cervina* (L.Koch) and further new species *H. willunga*, *H. rundle*, *H. monteithi*, *H. crediton*, *H. silvatica* and *H. cooloola*. *H. raveni* sp.nov. is unassigned to a group. The *hermitis* group contains new species *H. marillana*, *H. spenceri*, *H. hermitis* (Hogg) comb.nov., and further new species *H. cavernicola*, *H. renibulbis*, *H. kalbarri* and *H. grooteeylandt*. *Yiinthi* gen.nov. is described with eight species in two groups. The *spathula* group contains *Y. lycodes* (Thorell) comb.nov., and new species *Y. spathula*, *Y. chillagoe*, *Y. molloyensis* and *Y. anzsesorum*. The *kadadu* group comprises the new species, *Y. kakadu*, *Y. gallonae* and *Y. torresiana*. *H. keyserlingi* Hogg is a junior synonym of *H. cervina* (L. Koch, 1875). *Olios hermitis* is transferred to *Heteropoda* thus *O. hermitis* = *H. hermitis* (Hogg, 1914) comb.nov. *H. fusciventris* Chrysanthus is a junior synonym of *H. lycodes* Thorell = *Yiinthi lycodes* (Thorell, 1881) comb. nov. □ *Araneae, Australian Heteropodidae, new taxa.*

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Heteropoda is very widespread with over 100 species (Roewer, 1954; Brignoli, 1983; Platnick, 1989). It is one of several heteropodid genera occurring in the Indo-Australian region; recently Hirst has published revisions of *Pediana* (1989), *Isopeda* (1990), *Holconia* (1991a), *Eodelena* and *Zachria* (1991b) in Australia. Since the Australian species of *Heteropoda* were first described they have been revised by Simon (1880), Hogg (1902), and some by Jarvi (1912, 1914). Simon placed *Sarotes* Sundevall into synonymy with *Heteropoda* and resolved the confusion that resulted from Koch (1875) describing *Olios* species in *Heteropoda*. Hogg revised the Australian heteropodids (sparassids) and described a new species, *H. keyserlingi*. The spiders are large and fast moving and are common throughout coastal and near coastal areas of the northern half of Australia. In Queensland they achieve some notoriety as they are often found in suburban houses. Their bite is of minor consequence, possibly leading to local or mild general symptoms in the bitten person. Throughout Australia, most *Heteropoda* species are found in temperate and tropical rainforests, however *H. cervina* is found in drier vine thickets as well and *H. jugulans* is widely distributed in sclerophyll eucalypt forests; the '*hermitis*' species group is found in Western Australia and across northern Australia. The introduced species, *H. venatoria*, is found along the northern and eastern coasts and on islands of the Great Barrier Reef. Arising from this study a new heteropodid genus, *Yiinthi* is recognised. Maps (Figs 18-20) show the distribution of species so far as this is known. An index to species is given on p. 122.

Rockhampton has been recorded as a locality for *Heteropoda nobilis* (Koch) and its junior synonym, *H. suspiciosa* (Koch). ♂ *Sarotes nobilis* Koch, ?holotype in ZMH (Rack, 1961) has been examined. Measurements and structure concur with the original description of ♂ from Upolu, Samoa. From files at ZMH the reverse side of the label with this spider indicated it was from Rockhampton (Godeffroy No.11009). As Rack (loc.cit.) suggests this is almost certainly a

mistake. ♀ *Sarotes suspiciosus*, Koch ?syntype (ZMH) is without registration number or locality. It is the same species as ♀ *Sarotes suspiciosus* Koch from Upolu, Samoa in ZMB (No. 27010) and it is likely these are Koch's syntypes. Reference to Rockhampton as a second locality by Koch (1875: 666) is regarded as a mistaken locality. The abdominal pattern and the epigynal structure of *H. nobilis* are different from that found in any Australian *Heteropoda* sp. From the illustrations of *H. sartrix* (L. Koch, 1865) it appears not to belong in *Heteropoda*. *H. mindiptanensis* Chrysanthus, *H. rubra* Chrysanthus, *H. atriventris* Chrysanthus, *H. erythra* Chrysanthus and *H. sarotoides* Jarvi from Irian Jaya and Papua New Guinea have been examined; none has been found in Australia.

MATERIALS AND METHODS

Most of the material is lodged in the Queensland Museum (QM). For this study 'mideastern' Queensland is that area between latitudes 20°-25°S, 'northeastern' Queensland is to its north and 'southeastern' Queensland to its south; the Great Dividing Range roughly forms the western boundary of these areas. All measurements are in millimetres and are based upon ocular eyepiece measurements. Epigyna were excised and cleared in lactic acid.

A numeral preceding ♀ or ♂ in the lists of paratypes indicates more than one specimen, e.g. 2♂, 2♀ indicates 2 males and 2 females. In notating spines, the number on femora, patellae and tibiae is always given in the same order – prolateral, dorsal, retrolateral and ventral (present only on tibiae and metatarsi); numbers only are given without punctuation, e.g. tibiae III 2026. Characters given in the generic diagnoses are for the most part not repeated in the species descriptions.

Size classes. Female spiders are all large ranging between 8.0-25.0mm. Within this range the relatively small (8.0-13.9), medium (14.0-19.9) and large (20.0+) females are distinguished. Males of a species are usually smaller and may vary greatly in size.

Abbreviations Used

COLLECTORS: AE, Australian New Zealand Schools Exploration Society; AR, A. Rozefelds; CH, C. Horseman; DC, D. Cook; DJ, D. Joffe; DY, D. Yeates; EWQM, Earthwatch - Queensland Museum expedition; GJI, G.J. Ingram; GBM, G.B. Monteith; GT, G. Thompson; GVC, G.V. Czechura; HJ, H. Janetzki; JC, J. Covacevich; JG, J. Gallon; KRM, K.R. McDonald; LR, L. Roberts; NH, N. Hall; MG, M. Gray; PF, P. Filewood; RK, R. Kohout; RJM, R.J. McKay; RJR, R.J. Raven;, RM, R. Monroe; SRM, S.R. Monteith; SVD, S. Van Dyck; VED, V.E. Davies.

MORPHOLOGY: AL, abdomen length; AW, abdomen width; CL, carapace length; CW, carapace width. ALE, anterior lateral eyes; AME, anterior median eyes; PLE, posterior lateral eyes, PME, posterior median eyes; MOQ, median ocular quadrangle; AR, anterior row; PR, posterior row. ALS, anterior (lateral) spinnerets; PMS, (posterior) median spinnerets; PLS, posterior (lateral) spinnerets. See text for abbreviations on scanning micrographs. Abbreviations for museums are given in the 'Acknowledgements' section.

SYSTEMATICS

Family HETEROPODIDAE (SPARASSIDAE AUCT.)

The heteropodids, commonly known as 'huntsman spiders' are claw-tufted, 2-clawed spiders without cribellum or colulus. Most are laterigrade and the second pair of legs is the longest. The soft trilobate membrane distally on all metatarsi is the synapomorphy for the group; see Levy (1989: Fig. 1) for illustration. Metatarsi and tarsi with dense scopulae; tarsal claws pectinate in a single row; ♀ palp with claw. Two rows of four eyes which reflect torch-light at night; the tapetum is covered with uniform pores in *Heteropoda* and *Holconia*. Chelicerae free with 2 rows of marginal teeth.

Subfamily HETEROPODINAE

Roewer (1954) included two Australian genera, *Heteropoda* and *Pandercetes* in the Heteropodinae; Hirst (1989) added *Keilira*. In all of these the embolus is uncoiled and the epigynum lacks a sclerotized rim. These characters distinguish them from the Australian Eusparassinae (*Holconia, Isopeda, Isopodella, Beregama, Typostola, Zachria*) and the Deleninae (*Delena* and *Neosparassus*) in which the embolus is in a stack of coils and the epigynum has a sclerotized lateral rim. Brignoli (1983) listed the Heteropodidae alphabetically as he was "unable to decide on the value of the traditionally accepted subfamilies". Platnick

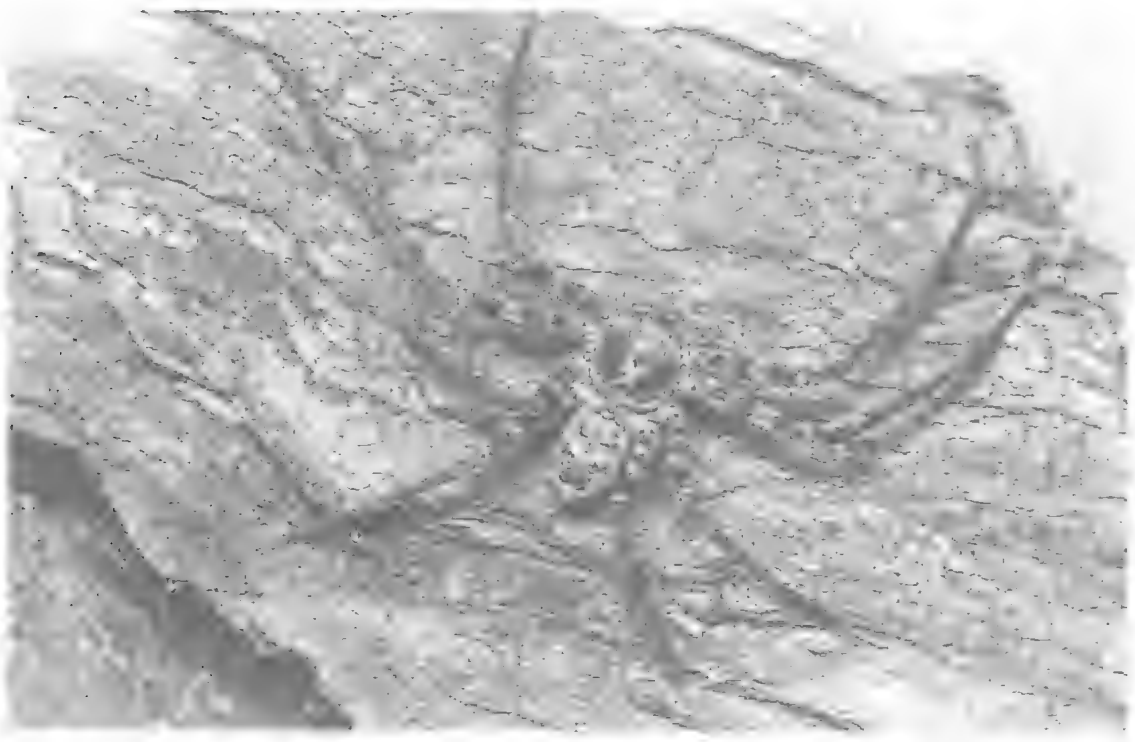

FIG. 1. ♀ *H. jugulans*, Brisbane.

(1989) also lists the heteropodids alphabetically. *Pandercetes* is a grey-green tree-dwelling spider from northern Queensland rainforest and is easily distinguished from *Heteropoda* and *Yiinthi* gen.nov. by its colour and the lateral fringes of hair on the legs. *Keilira* is a small speckled spider from SE South Australia and SE Victoria, also easily distinguished from *Heteropoda* and *Yiinthi* gen.nov.

Heteropoda and *Yiinthi* gen.nov. have a characteristic and similar colour pattern (Fig. 1). Cephalic region orange-brown with darker brown laterally and in eye region. Thoracic region orange-brown, a broad light-coloured band posteriorly which may extend laterally; small dark areas marginally, slightly anterior to each leg position; dark patch at anterior end of fovea and large dark crescent-shaped area around posterior end of fovea that spreads forwards to a variable extent; usually 4 pairs of dark lines radiating towards legs. Chelicerae brown with 3 longitudinal bands of hair. Legs brown, femora light coloured, tibiae orange-brown, metatarsi and tarsi often dark brown. Dorsal abdomen with 3 pairs of dark spots and broad open W or chevron of dark hair posteriorly; venter pattern variable. Carapace a little longer than wide, broadly pear-shaped. Thoracic region of carapace higher than cephalic region in females; regions usually level in males. Chelicerae with 3 teeth on promargin - middle tooth largest - and 4 teeth on retromargin with proximal tooth the smallest; a cluster of denticles (Fig. 3C) inside promarginals. Endites longer than wide with serrula; labium about as wide as or wider than long; sternum about as wide as long. Both rows of eyes recurved (with one exception); eye group about twice as wide as long; MOQ longer than wide, sometimes barely so. Median eyes smaller than laterals; AME smallest, closer to ALE than each other; PME closer to each other than to PLE. Clypeus usually about x2 AME (Fig. 11C). Second pair of legs always longest; first pair of legs usually second longest, though sometimes fourth pair is equal to or slightly longer than first. Tegulum of ♂ palp varies in shape; embolus long; conductor membraneous, long; without median apophysis; ♂ tibial apophysis well developed without dorsal element. Epigynum consists of external lateral lobes and a median septum that varies in shape; internal insemination ducts arise (at gonopores) on either

side of septum and lead to spermathecae; short fertilization ducts connect with the uterus.

MAIN TAXONOMIC CHARACTERS

Ventral abdominal pattern. The trapezoid area between the epigastric furrow and spinnerets may be pale, mottled but show no definable pattern, or have a constant darker pattern relieved by pale lines or lines of pale spots.

Male palp. Shape of the tegulum, presence or absence of a tegular process and direction in which it points are considered. Origin of the embolus on the tegulum may be antero-, mid- or postero-retrolateral; embolus may be filiform or thick and have a flagellum. Origin and length of the tegular flange is diagnostic for some species. Conductor may taper to a point or be spoon-shaped distally. Presence and position of "tooth" on tibial apophysis is noted.

Epigynum. Insemination ducts may be narrow, wide, coiled or bag-like; if coiled the number of coils is usually diagnostic. When counting coils the looped apex formed by the duct before it runs back through the coils to the spermatheca is not counted.

KEY TO GENERA

♀ insemination ducts coil forward one (occasionally reduced to ½) or more times, fold back to run through centre of coil(s) to spermathecae. ♂ embolus long and filiform ..... *Heteropoda*

♀ wide short insemination ducts; loosely looped elongate spermathecae. ♂ long thick embolic structure with *pars pendula* and sub-terminal flagellum ..... *Yiinthi*

Heteropoda Latreille, 1804

Heteropoda Latrielle, 1804: 135; Simon, 1880: 267; Hogg, 1902: 416; Jarvi, 1914: 197 [nec Koch, 1874, 1876].

Sarotes Sundevall, 1833: 28 (type species *Aranea regia* Fabr.); C.L. Koch, 1837: 27; L. Koch, 1874: 494; L. Koch, 1876: 659; synonymy by Simon, 1880: 267.

Ocypete C.L. Koch, 1836: 40 (type species *Micrommata setulosa* Perty, 1833 = *H. venatoria*); synonymy by Simon, 1880: 267.

Ethilla Simon, 1874, p.267 (type species *Ethilla variegata* Simon, 1874); synonymy by Simon, 1880: 267.

TYPE SPECIES

Aranea venatoria Linnaeus by subsequent designation of Thorell (1870).

DIAGNOSIS (Australian spp.)

Thick membraneous conductor arises prolaterally on proximal tegulum and tapers to a point; it twists so that inner edge becomes outer edge distally. Embolus, long and filiform arises retrolaterally on distal tegulum and curves down, across and forward to lie on outer edge of conductor. In most species insemination ducts coil forward one or more times then fold back to run through centres of coils to spermathecae.

DESCRIPTION

Dorsal abdomen with 3 pairs of dark spots and broad open W of dark hair posteriorly. Legs laterigrade, 2143 or 21=43. Scopulae on all metatarsi and tarsi. Tarsi short, less than a third as long as metatarsi. Spines usually present on femora, patellae, tibiae and metatarsi; none on tarsi. Femora I-III almost always have 3 prolateral, 2 dorsal and 3 retrolateral spines (abbreviated to '323' throughout), femora IV usually have only 1 retrolateral spine (321). Patellae I-IV have 1 prolateral, 0 dorsal, 1 retrolateral (101), occasionally a spine is absent. Tibial spines show more variation; in males there are 2 prolateral, 2 or 3 dorsal, 2 retrolateral and 6 (in pairs) ventral spines (22(3)26); in females there are usually 2 prolateral, 0 or 2 dorsal, 2 retrolateral and 6 ventral spines (20(2)26). Metatarsal spines are many and variable. Many trichobothria (Fig. 3A) in two lateral groups on proximal tibiae, dorsal and retrolateral metatarsi, and in 2-3 irregular, distally diverging rows on tarsi. Small tarsal organ (Fig. 3B) far forward on retrolateral face of tarsus near base of claw.

Male palp (Fig. 2A-C, E-M). Sub-tegulum saucer-shaped. Proximal tegulum flat with prolateral flange, distal tegulum (referred to as 'tegulum') bulbous with or without posterior prolateral process (tegular process). Membraneous conductor long and tapering to a point. Embolus, long and filiform, occasionally rounded or bifid at tip. Insemination ducts with between half a coil and seven coils before entering spermathecae.

Spinnerets of H. jugulans (Fig. 3D-I). ALS broader but shorter than PLS. ALS have two major ampullate gland spigots (Map) and many piriform spigots (pi) arranged in 2 groups. In the female the PMS have three anteromedian spigots (Fig. 3F-H), two of which are absent in the male

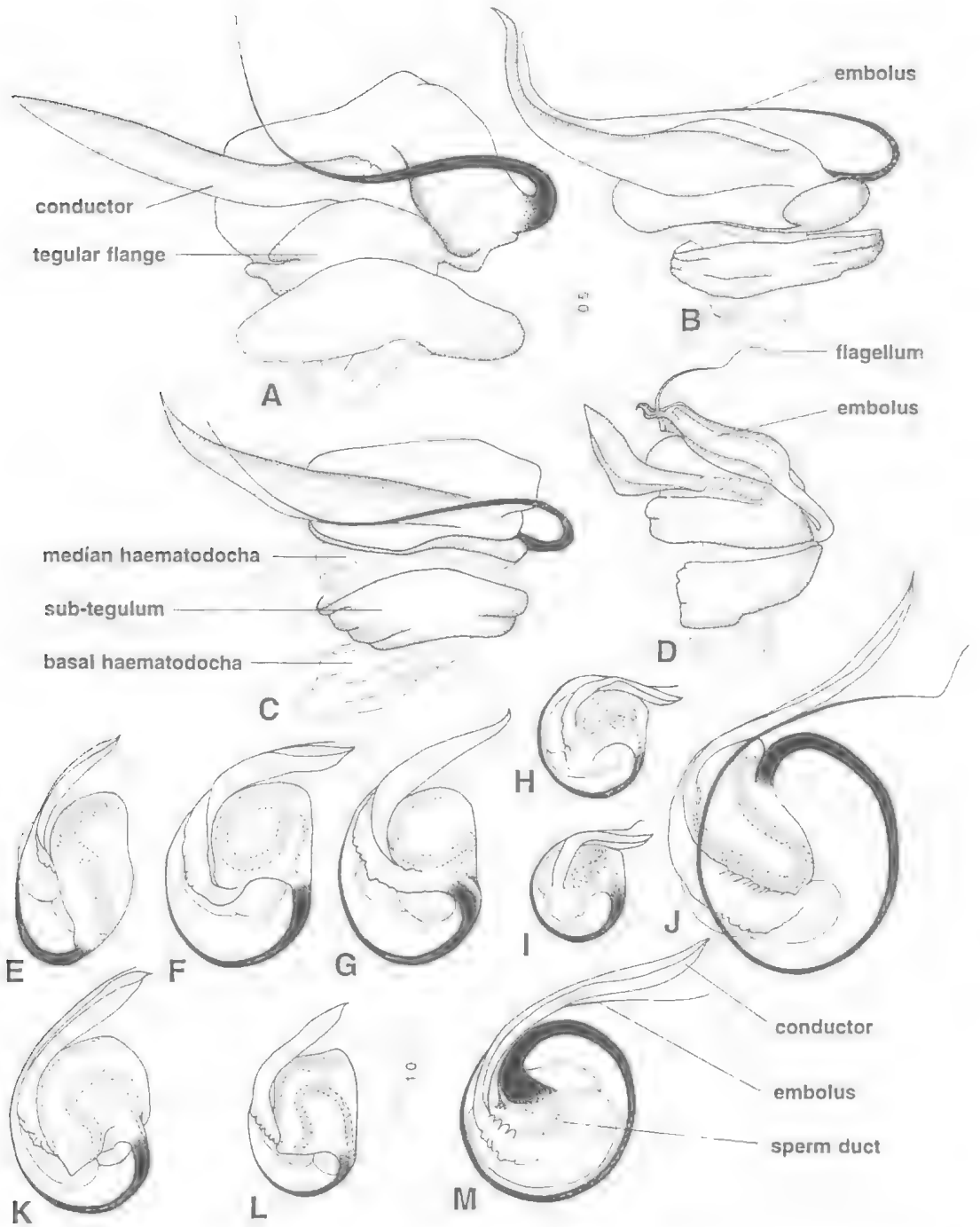

FIG . 2. A, *Heteropoda venatoria*; B, *H. procera*; C, *H. jugulans;* D, *Yiinthi spathula*; E, *H. venatoria*; F, *H. procera*; G, *H. longipes;* H, *H. mossman;* I, *H. bellendenker*; J, *H. renibulbis;* K, *H. jugulans*; L, *H. cervina;* M, *H. marillana.* A-M, ♂ palps (A-D, expanded; E-M, bulbs showing origin of embolus and course of sperm duct).

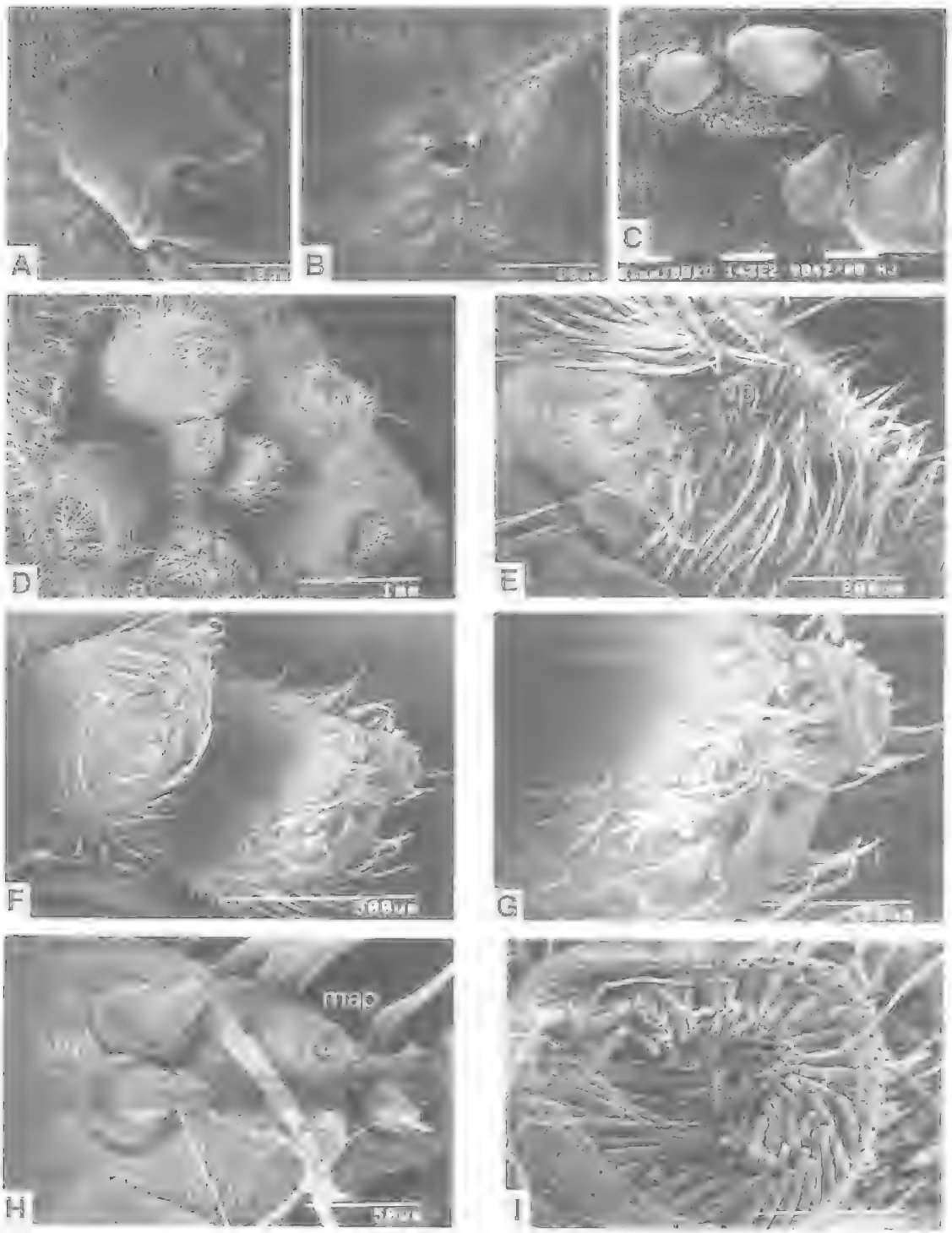

FIG. 3. *Heteropoda jugulans*. A, bothrium; B, tarsal organ; C, denticles between cheliceral teeth; D, ♀ spinneret field; E, anterior spinnerets; F-H, median spinnerets; I, posterior spinnerets.

and are presumably cylindrical gland spigots (cyl). The third spigot is also present in the ♂ and is regarded as the minor ampullate gland spigot (map); a scar (? tartipore) is also present in this area in the male. An enlarged posterior spigot in the ♀ may also be a cylindrical gland. Other spigots varying in size are regarded as aciniform spigots; in the male these are uniform in size. The PLS have many aciniform spigots.

KEY TO AUSTRALIAN *HETEROPODA* SPP.

1. Lateral lobes of ♀ epigynum closely apposed (Fig. 4A). ♂ tegulum almost twice as long as wide; tapering posteriorly (Fig. 2E) ..... *venatoria*

Lateral lobes of ♀ epigynum separated by median septum (Figs 4L,6C). ♂ tegulum otherwise 2

2. ♀ median septum flat or rounded; insemination duct with ½-3 coils (Fig. 4D). ♂ embolus arising posteriorly on tegulum (Fig. 2F) 3

♀ median septum with longitudinal ridge (at least anteriorly) (Fig. 13G); insemination duct with ½ or 3½-7 coils. ♂ embolus arising anteriorly or antero-retrolaterally on tegulum (Fig. 2J) 31

3. ♀ median septum short with narrow neck region (usually in concavity) broadening to transverse bar posteriorly (Fig. 4H). ♂ without tegular process or postero-prolateral tegular bulge (Fig. 2G); short prolateral tegular flange about half as long as tegulum (Fig. 2B) 4

♀ medium septum long, tongue-like with slight narrowing of neck (not in concavity) (Fig. 6C). ♂ with tegular process (Fig. 6E) or bulge postero-prolaterally (Fig. 9E) sometimes reduced (Fig. 10A); long prolateral tegular flange almost as long as tegulum (Fig. 2C) 9

4. Medium-large. ♀ insemination duct less than 1 coil. ♂ tegular flange arising posteriorly and extending forward to half-way up tegulum; embolus tapering to tip; tibial apophysis tapering to point (Fig. 4E) ..... *procera* group 5

Small-medium. ♀ insemination duct ½-1½ coils. ♂ tegular flange arising mid-laterally and extending to anterior end of tegulum; embolus with rounded or branched tip; tibial apophysis, flat distal blade (Fig. 7B) 7

5. ♀ median septum evident (Fig. 4C,H). ♂ tibial apophysis long, slender. No dorsal spines on ♂ tibiae IV ..... *procera*

♀ median septum evident or barely so. ♂ tibial apophysis short, stout. Two-3 dorsal spines on ♂ tibiae IV 6

6. Neck of median septum barely evident (Fig. 4F). ♂ tibial apophysis tapering to point (Fig. 5F). Two dorsal spines ♂ tibiae III ..... *longipes*

Neck of median septum clearly evident (Fig. 4L). ♂ tibial apophysis ending bluntly (Fig. 5H). Three dorsal spines ♂ tibiae III ..... *binnaburra*

7. Medium size. Trapezoid area of venter brown with 2 pale paramedian stripes. ♀ insemination duct with ½ coil. Tegular flange normal width; embolus bifid (Fig. 4P); tibial apophysis without marked heel ..... *gordonensis*

Small. Venter mottled. ♀ insemination duct 1-1½ coils. Tegular flange broad giving ear-shaped appearance (Fig. 2H); embolus with rounded tip; tibial apophysis anvil-shaped with proximal heel (Fig. 7B), flat distal blade ..... *bellendenker* group 8

8. ♀ insemination duct with one coil. ♂ sperm duct with one main tegular loop before entering embolus (Fig. 2I), tibial apophysis up-turned at tip ..... *bellendenker*

♀ insemination duct with 1½ coils. ♂ sperm duct with second small loop before entering embolus (Fig. 2H); tibial apophysis down-turned at tip ..... *mossman*

9. ♀ median septum clearly shorter than lateral lobes. ♂ tibial apophysis without tooth ..... *jugulans* group 10

♀ median septum almost as long as or longer than lateral lobes (Fig. 11D). ♂ tibial apophysis with tooth (Fig. 11F) ..... *cervina* group 20

10. Trapezoid area of venter with dark V pattern (Fig. 6B). ♀ insemination duct with 2-3 coils. ♂ tegular process pointed in posterior direction (Fig. 2K) 11

Trapezoid area of venter, pale, mottled (occasionally with V pattern) or dark with pattern of light spots. ♀ insemination duct with less than 2 coils. ♂ tegular process pointed in posterior or prolateral direction, blunt or reduced 12

11. ♀ insemination duct with 2 coils (Fig. 6D) ..... *jugulans*
♀ insemination duct with 3 coils (Fig. 6I) ..... *alta*

12. Trapezoid area of venter pale or mottled ... 13
Trapezoid area of venter dark with two pale longitudinal bands 18

13. Trapezoid area mottled. ♂ tegular process pointed or low rounded prolateral bulge ... 14
Trapezoid area pale. ♂ tegular process, a postero-prolateral bulge or reduced 16

14. Medium size. Venter mottled with darker V pattern posteriorly. ♀ insemination duct one coil. ♂ tegular process pointing posteriorly (Fig. 7H) ..... *hillerae*
Medium-large. Venter without V pattern. ♀ insemination duct. ♂ tegulum with blunt process or rounded prolateral bulge 1-1½ coils 15

15. Large. ♀ insemination ducts 1-1½ coils. ♂ tegular process directed ventro-prolaterally ..... *cooki*
Medium. ♀ insemination ducts one coil. ♂ low rounded postero-prolateral tegular bulge (Fig. 9B) ..... *nagarigoon*

16. ♀ insemination duct ½ coil. ♂ tegular process reduced to tiny prolateral bump (Fig. 9C); tibial apophysis distally bifurcate (Fig. 9D) ..... *holoventris*
♀ insemination duct 1½ coils (Fig. 8G). ♂ rounded postero-prolateral tegular bulge (Fig. 9E); tibial apophysis pointed 17

17. Medium. Two dorsal spines ♂ tibiae III, IV. ..... *vespersa*
Large. Three dorsal spines ♂ tibiae III, IV (♀ unknown) ..... *warrumbungle*

18. Trapezoid area of venter with 2 pale irregular longitudinal bands (Fig. 8K). ♀ insemination duct with 1½ coils. ♂ tegular process pointed in ventro-prolateral direction (Fig. 9G) ..... *distincta*
Trapezoid area of venter with 2 pale stripes or lines of spots. ♀ insemination duct with ½-1 coil. ♂ tegulum with or without rounded prolateral bulge 19

19. Trapezoid area with 2 short, thick median stripes. Sternum patterned (Fig. 8N). ♂ tibia III with 1 dorsal spine; rounded prolateral tegular bulge (Fig. 9I). ♀ neck of median septum narrow; insemination duct with 1 coil ..... *eungella*
Trapezoid area with 2 lines of 2-7 white spots (Fig. 8Q). Sternum unpatterned. ♂ tibia III with 2 dorsal spines; without tegular bulge (Fig. 10A). ♀ neck of median septum gradually widening, triangular in shape; insemination duct with ½ coil ..... *conwayensis*

20. ♂ without pointed tegular process, with slight round bulge on postero-prolateral tegulum (Fig. 10C) (♀ unknown) ..... *monteri*
♂ with pointed tegular process 21

21. ♀ median septum almost as long as lateral lobes (Fig. 8R); insemination duct with 1 coil. ♂ tegular process pointing prolaterally (Fig. 10E); tibial apophysis broad, sharply truncated with marginal tooth on posterior corner (Fig. 10F). ..... *goonaneman*
♀ median septum as long as or longer than lateral lobes; insemination duct with ½-3 coils. ♂ tegular process pointing prolaterally or posteriorly; tibial apophysis rounded distally with central or sub-marginal tooth 22

22. Trapezoid area of venter pale or mottled 23
Trapezoid area of venter dark with two longitudinal pale stripes or lines of spots 25

23. ♀ insemination duct 1½ coils (Fig. 8U) (♂ unknown) ..... *spurgeon*
♀ insemination duct less than 1 coil 24

24. ♀ median septum extending to lateral lobes; insemination duct loose ¾ coil (Fig. 8W). ♂ tibial apophysis distally bifid with tooth on posterior branch (Fig. 10H) ..... *bulburin*
♀ median septum extending beyond lateral lobes; insemination duct tight ½ coil (Fig. 11B). ♂ tibial apophysis rounded distally

with sub-distal tooth on posterior edge (Fig. 10I) ..... *acuta*

25. ♂ tegular apophysis pointed in ventro-prolateral direction; tibial apophysis with large central tooth (Fig. 11F) 26
♂ tegular apophysis pointed in posterior direction; tibial apophysis with smaller posterior, sub-marginal tooth (Fig. 12I). .. 29

26. Large. ♀ insemination duct with 1-1½ coils. ♂ tibia III, 3(2) dorsal spines. Embolus reaching three-quarter length of conductor ... .27
Small-medium. ♀ insemination duct with 2-3 coils. ♂ tibia III, 2 dorsal spines, Embolus reaching almost to end of conductor 28

27. ♀ median septum width: length, 1:3; insemination duct with 1½ coils, tight apical fold (Fig. 11E) ..... *cervina*
♀ median septum width: length, 1:2; insemination duct with 1 coil, loose apical fold (Fig. 11H) ..... *willunga*

28. ♀ insemination duct with 2 coils (Fig. 11J) ... . *rundle*
♀ insemination duct with 3 coils (Fig. 11L) ... . *monteithi*

29. Large. ♀ median septum extending to lateral lobes; insemination duct 3 coils (Fig. 11Q). Sperm duct with small coil before entering embolus ..... *crediton*
Medium size. ♀ median septum extending beyond lateral lobes; insemination duct with less than 3 coils. Sperm duct without coil before entering embolus 30

30. ♀ insemination duct with 2 loose coils and tight apical fold (Fig. 11T). ♂ tegulum about as wide as long ..... *silvatica*
♀ insemination duct with 1 coil and loose apical fold (Fig. 11N). ♂ tegulum visibly longer than wide (Fig. 14A) ..... *cooloola*

31. Clypeus more than X 2 AME (Fig. 13C). MOQ as wide as long. Legs 2413. ♀ insemination ducts ½ coil (♂ unknown) .... *raveni*
Clypeus less than X 2 AME. MOQ slightly longer than wide. Legs 2143 or 21=43. ♀ insemination ducts 3½-7 coils ..... *hermitis* group 32

32. Small, round, distal tegulum (Fig. 13F); tibial apophysis forming about 45° angle with axis of cymbium; distal hook on posterior edge of apophysis (♀ unknown) .... *marillana*
Kidney-shaped, oval tegulum (Fig. 14C); tibial apophysis forming smaller angle with axis of cymbium, without hook on apophysis 33

33. ♀ median septum with short broad anterior ridge; insemination duct with 3½ coils ... 34
♀ median septum with longer ridge reaching at least half-way (Fig. 15A); insemination duct with 5 or more coils 36

34. ♀ median septum heart-shaped narrowing posteriorly (Fig. 13D) (♂ unknown) .... *spenceri*
♀ median septum not heart-shaped, as wide or wider posteriorly 35

35. ♀ median septum as long as lateral lobes (Fig. 13I). ..... *hermitis*
♀ median septum shorter than lateral lobes (Fig. 13G) (♂ unknown) ..... *cavernicola*

36. Ridge on median septum running about half length of septum; 6-7 coils in insemination ducts ..... *renibulbis*
Ridge on median septum running length of septum; 5 coils in insemination ducts 37

37. Median septum broadening in middle, shorter than lateral lobes (Fig. 15A) (♂ unknown) ..... *kalbarri*
Median septum more or less parallel-sided, longer than lateral lobes (Fig. 15C)(♂ unknown) ..... *grooteeylandt*

Heteropoda venatoria (Linnaeus, 1767) (Figs 2A,E; 4A,B; 5A,B; 18)

Aranea venatoria Linnaeus, 1767: 1035.
Aranea regia Fabricius, 1793: 408.
Heteropoda venatoria: Latreille, 1804: 135; Simon, 1880: 268; Bonnet, 1957: 2196.
Micrommata setulosa Perty, 1833: 195.
Olios leucosius Walckenaer, 1837: 566.

MATERIAL EXAMINED
Spiders from Brisbane, Rockhampton, Townsville, Heron I., North West Islet, Thursday I., (Queensland); Balmoral (New South Wales); Darwin (Northern Ter-

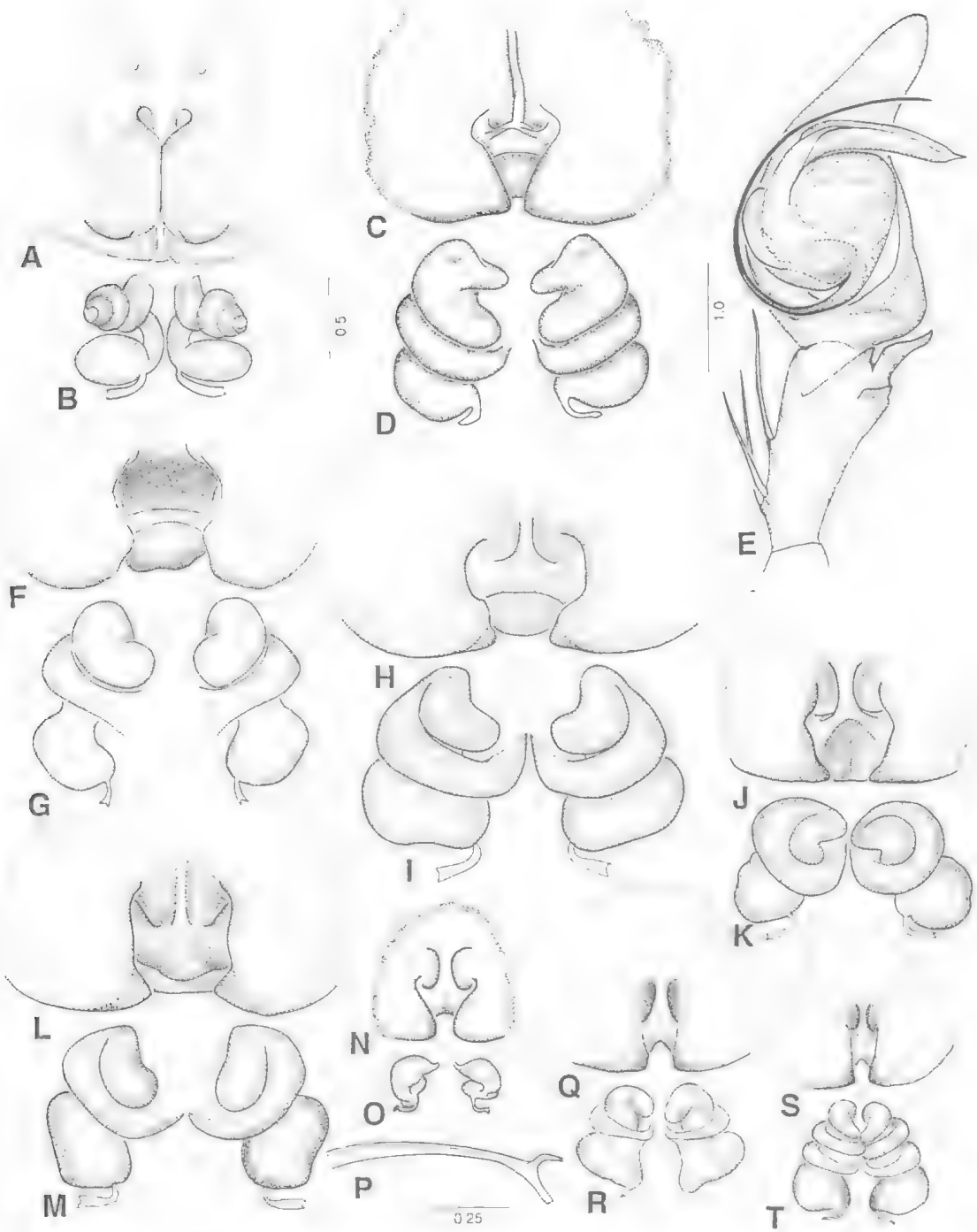

FIG. 4. A,B, *Heteropoda venatoria*; C-E, H-K, *H. procera* (C,D paratype; H, I, Brisbane; J,K, Gibraltar Ra.); F,G, *H. longipes*; L,M, *H. binnaburra;* N-P, *H. gordonensis;* Q-R, *H. bellendenker*; S-T, *H. mossman.* A-D, F-O, Q-T, external and internal epigyna; E, ♂ palp; P, ♂ embolus.

ritory); Cocos Keeling Is and Christmas I (Indian Ocean).

DIAGNOSIS

Large spiders. Dorsal abdomen with dark medial band anteriorly; venter yellow-brown without pattern or with 2 fine paramedial brown lines. Clypeus with marked band of white hairs. Cymbium of male usually with spine on prolateral edge of alveolus. Tegulum twice as long as wide; embolus filiform; sheath-like conductor arising on distal half of prolateral tegulum, prolateral flange of tegulum broad and short, unattached to tegulum distally; tibial apophysis short, distally indented (Fig. 5A,B). Lateral lobes of epigynum touching medially; insemination ducts coiled dorsally (rather than anteriorly) with 1½ coils (Fig. 4A,B).

DESCRIPTION

Male: Carapace length about 8mm. Spination: femora I-II 323, III 333, IV 331; patellae I-IV 101; tibiae I, II 2326, III, IV 2226.

Female: Carapace length about 10mm. Spination femora I, II 323, III 333, IV 331; patellae I-IV 101; tibiae I-IV 2026.

DISTRIBUTION

Pantropical; in coastal areas of Australia and on Great Barrier Reef islands (Fig. 18).

REMARKS

Further figures of *H. venatoria* are given in Chrysanthus (1965). Details of synonymy are given in Bonnet (1957) and Roewer (1954).

THE *PROCERA* GROUP

Medium to large spiders. Venter pale or with posterior mottling. MOQ longer than wide; clypeus a little longer than AME. Three dorsal spines on femora III and IV. Smooth, rounded tegulum without process or bulge; short wide prolateral tegular flange about half as long as tegulum; tibial apophysis smooth, without 'tooth'. Short ♀ median septum with narrow to barely evident anterior region, broadening to transverse bar; insemination ducts less than one coil.

Heteropoda procera (L. Koch), *H. longipes* (L. Koch), *H. binnaburra* sp.nov.

Heteropoda procera (L. Koch, 1867)
(Figs 2B,F; 4C-E, H-K; 5C,D; 19A)

Ocypete procera L. Koch, 1867: 205.
Sarotes procerus: L. Koch, 1875: 660, 667.
Heteropoda procera: Simon, 1880: 270; Hogg, 1902: 416.

TYPE MATERIAL

Ocypete procera. The holotype ♂ from Brisbane, was not located in the Naturhistorisches Museum, Vienna. However the ♂ *Sarotes procerus*, as re-described by Koch (1875), which has almost identical measurements to those ascribed to the holotype was examined: ♂, Bowen, BMNH1915.3.5.6467. This locality is questioned (see later remarks) and the specimen is regarded as the probable holotype from Brisbane.

♀ *Ocypete procera* paratype, Brisbane, Godeffroy No. 2262, ZMH.

OTHER MATERIAL EXAMINED

Southeastern Queensland: ♂, Brisbane, QMD15015; ♀, Mt Archer, Kilcoy, QMS15095; ♂, Gold Ck, Brookfield, QMS15073; ♀, Hidden Valley Plantation, Beerwah, QMS15096; ♂, Teviot Brook, QMS15049; 2 ♂, Casey Ck via Imbil, QMS15102; ♂, Booloumba Ck, QMS15098; ♂, Boyce Reserve, Toowoomba, QMS15104; ♀, QMS15100; ♀, Eumundi, QMS15053. ♀, Bunya Mts National Park, QMS15106; 20 ♂, 19 ♀, Dandabah, Bunya Mts National Park, QMS15110; ♂, Closeburn, QMS15052; ♀, Cooloola, QMS15099; 2 ♀, Kilcoy Ck, QMS15094; 2 ♂, ♀, Daves Ck Country, Lamington National Park, QMS15109; ♂, O'Reillys, QMS15045. ♀, Mt Glorious, QMS15060; ♀, QMS15088; ♂, QMS15086; ♂, QMS15504. ♀, Mt Tamborine, QMS21001; ♂, QMS15050; ♂, North Stradbroke Is, Point Lookout, QMS15090; ♂, Slipping Sands, QMS15047; ♂, Conondale Range, QMS15051; ♂ Cunninghams Gap, QMS15048. Mideastern Queensland: ♀, Kroombit Tops State Forest, QMS15093; ♂, ♀, Beauty Spot, QMS15078, ♀, Three Moon Ck, QMS15071; ♂, QMS15072; 3♂, Beauty Spot, QMS15092; ♂, ♀, QMS15083; ♀, QMS15055; ♀, QMS15070; ♀, QMS15054; ♀, Kroombit Crossing, QMS15079. ♂, Bulburin State Forest, QMS15075. New South Wales: ♀, Gibraltar Ra., QMS15076.

DIAGNOSIS

Medium to large. Trapezoid area of venter pale without mottling. Tegulum almost as wide as long; tibial apophysis smooth, slender. Anterior median septum of epigynum narrow, clearly evident.

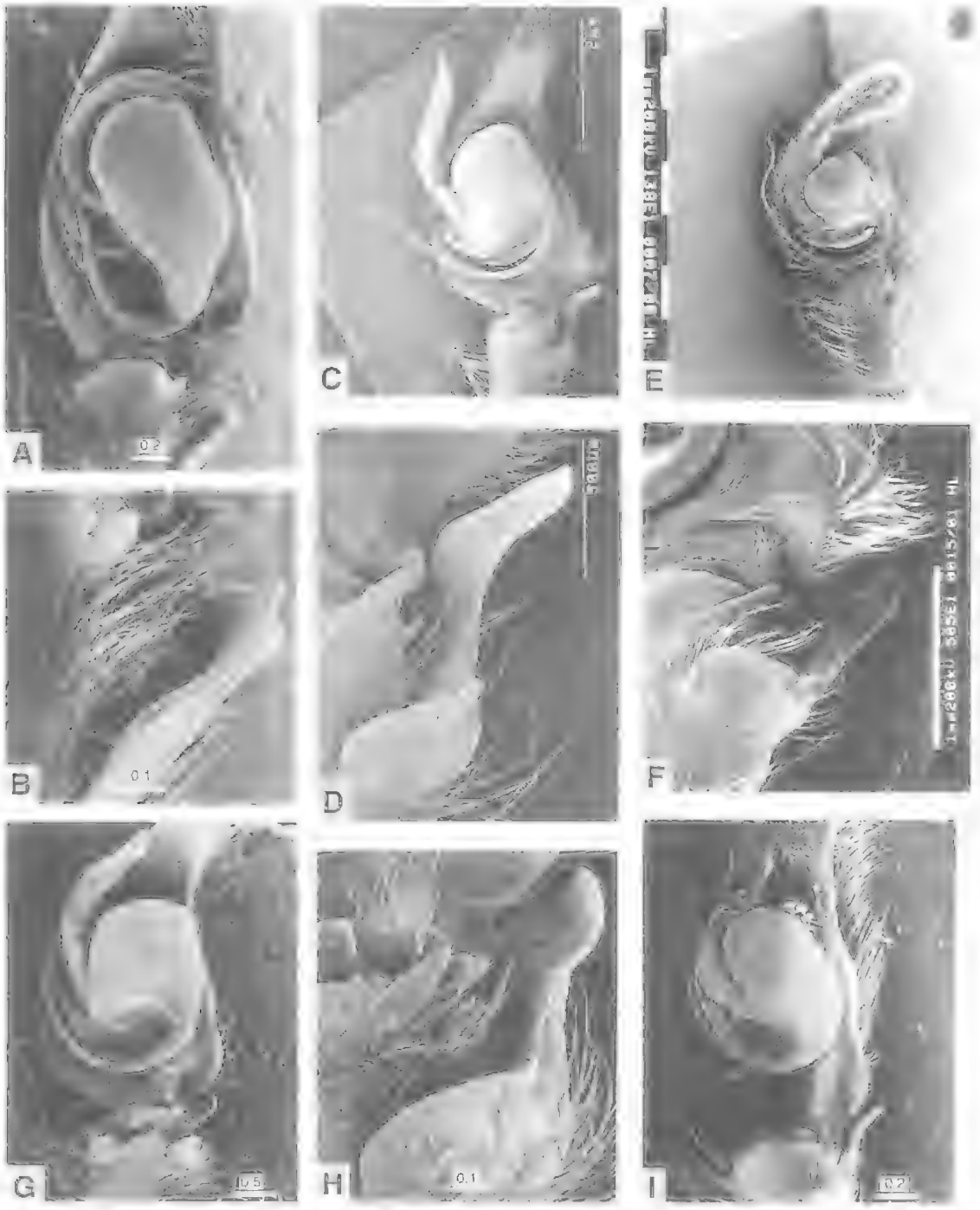

FIG. 5. A,B, *Heteropoda venatoria*; C,D, *H. procera*; E,F, *H. longipes*; G,H, *H. binnaburra*; I, *H. gordonensis*. A-I, ♂ palps and tibial apophyses.

DESCRIPTION

Male (presumed holotype): CL 8.0, CW 7.6, AL 9.0, AW 5.3. Spination: femora I, II 323, III 333, IV 331, patellae I-III 101, IV 001; tibiae I, II 2326, III 2226, IV 2026. ♂ palp (Figs 4E; 5C,D). Variation: Dorsal tibial spines on males from Kroombit Tops were erratic III 2(3), IV 1(2).

Female (paratype): CL 9.2, CW 8.3, AL 12.7, AW 8.0. Spination: femora I, II 323, III 333, IV 331; patellae I, II 101, III 001, IV 000; tibiae I, III, IV 2026, II 2126. Epigynum (Fig. 4C,D,H,I): insemination duct with half a coil. Variation: depth of the transverse bar of the median septum varied between females from different localities. Those from the Gibraltar Range, N.S.W. (Fig. 4J,K) may warrant a new species when the ♂ is described.

REMARKS

Originally Koch (1867) described a male and female from Brisbane. In redescribing the species, Koch (1875) did not assign his male or female to a specific locality. The male, described before the female, is presumed to be from Bowen, the first locality that Koch (1875) mentioned. Measurements of the male given by Koch (1867, holotype) and Koch (1875, given in brackets) agree remarkably closely: CL, 8(8); leg I, 44(44); leg II, 50(50); leg III, 38(37.5); leg IV, 37(38); they also agree fairly closely with measurements (by RJR) of palp and legs of the presumed holotype (8.08, 41.83, 49.97, 36.66, 39.95). The spination of the femora, patellae and tibiae, agree exactly with that described by Koch (1867). Therefore, it is presumed that the BMNH male is the holotype and that the locality label in the vial is incorrect; it should be Brisbane. This view is supported by the absence of *H. procera* in collections north of Bulburin State Forest, 24°31'S, 151°29'E (Fig. 19A).

Heteropoda longipes (L. Koch, 1875)
(Figs 2G; 4F,G; 5E,F; 18)

Sarotes longipes L. Koch, 1875: 659, 660.
Heteropoda longipes: Simon, 1880: 269; Strand, 1907: 464.

TYPE MATERIAL

HOLOTYPE ♂, Sydney, New South Wales, Koch coll. BMNH1915.3.5.6463. Koch (1875: 662) stated that his material came from the Bradley Collection.

OTHER MATERIAL

New South Wales: ♂, ♀, Lindfield, Sydney, AMKS15769; ♀, Bondi, Sydney, AMKS15762; ♂, Clifton Gardens, Sydney, AMKS15764; ♀, Longueville, AMKS15765; 2♀,♂, O'Sullivan's Gap, SAMAN1990328-30; ♀, Comboyne Cave, KSS-C4, AMKS803; ♂, Carrai Bat Cave, KS5, 80km W of Kempsey, AMKS804; ♂, Kiwarrak State Forest nr Taree, AMKS6308; ♀, Watagan State Forest nr Morrisset, AMKS8957; ♂, MacGrath I, Myall Lakes, AMKS15763; ♂, Upper Missabotti nr Bowraville, AMKS16299; ♂, Avoca, AMKS19620.

DIAGNOSIS

Pale venter with posterior mottling. Tegulum slightly wider than long; tibial apophysis short, stout with curved tapered tip (Fig. 5E,F). Anterior median septum of epigynum barely evident, leaving only transverse bar (Fig. 4F,G).

DESCRIPTION

Male (Lindfield): CL 8.0, CW 7.8, AL 8.8, AW 6.3. Holotype: CL 7.5, AL 8.0. Spination: femora I, II 323, III 333, IV 331; patellae I-III 101, IV 000; tibiae I-III 22(3)26, IV 2126.

Female (Lindfield): CL 8.3, CW 7.5, AL 10.0, AW 6.0. Spination: femora I, II 323, III 333, IV 331; patellae I-III 101, IV 100; tibiae I, IV 2026; II, III 2126. Epigynum: insemination duct less than one coil.

REMARKS

Strand's (1907) male *H. longipes* was in the Stuttgart Collections that were destroyed.

Heteropoda binnaburra sp.nov.
(Figs 4L,M; 5G,H; 19A)

TYPE MATERIAL

HOLOTYPE: ♂, Binna Burra, Lamington Nat. Pk, southeastern Queensland, 28°12'S, 153°11'E, 27-30.iii.1976, RJR, VED, QMS15074.

PARATYPES: Southeastern Queensland: Lamington National Park: ♀, Binna Burra, 27-30.iii.1976, RJR, VED, QMS15077; 2 ♂, same data, QMS15062; 3 ♀, QMS21002; 2 ♀, QMS15061; 2 ♂, Nagarigoon, 8.iv.1976, RJR, VED, M. Bishop, QMS15064; 3 ♀, same data, QMS15065; 3 ♀, QMS15063; 2 ♂, QMS15043; ♂, O'Reilly's, 28°14'S, 153°08'E, 1.xi.1989, RJR, QMS16519; ♀, Mt Hobwee, 8.iv.1976, RJR, VED, QMS15085; ♂, Binna Burra, 18.v.1983, D. Court, QMS15082. Mt Tamborine: ♀, viii.1974, VED, QMS15059; ♂, 10.vii.1974, VED, QMS15087, ♂, Rathdowney, 28°13'S, 152°52'E, xii.1975, C. Corben, QMS15044. ♀, The Head, Killar-

ney, 21°18'S, 151°26'E, iii-iv.1975, GBM, SRM, QMS15057. Northern New South Wales: ♂, Stotts I., Tweed R., 28°16'S, 153°30'E, 17-19.xi.1978, JC, GVC, RJR, QMS15081; ♂ ♀, Richmond Ra. State Forest, 28°27'S, 152°20'E, 17-18.iv.1976, RJR, QMS15067; ♂, Whian Whian State Forest, 28°38'S, 153°19'E, 9-12.ix.1976, RJR, QMS15046; ♀, Cherry Tree, Malanganee, 28°54'S, 152°43'E, GBM, QMS15058; ♀, Victoria Park via Alstonville, 28°50'S, 153°26'E, 26.viii.1974-23.iii.1975, GBM, SRM, QMS15105; ♀, Brindle Ck, Wiangarie State Forest, 28°38'S, 152°58'E, 27.xii.1974-23.iii.1975, GBM, SRM, QMS15108.

OTHER MATERIAL

Northern New South Wales: ♂, Bruxner Pk, Orara East State Forest, Coffs Harbour, SAMAN1990334; ♀, Brunswick Heads, SAMAN1990335.

ETYMOLOGY

From the type locality, Binna Burra, Lamington National Park.

DIAGNOSIS

Large. Trapezoid area of venter pale. Three dorsal spines on ♂ tibiae III.

DESCRIPTION

Male (holotype): CL 9.2, CW 8.4, AL 10.0, AW 6.2. Spination: femora I, II 323, III 333, IV 331; patellae I-III 101, IV 001; tibiae I-III 2326, IV 22(1)26. ♂ palp: tibial apophysis short, thick with bulge on anterior edge, blunt tip (Fig. 5G,H).

Female: CL 10.0, CW 9.5, AL 14.4, AW 9.0. Spination: femora I, II 323, III 332, IV 331; patellae I-III 101, IV 000; tibiae I-III 2126, IV 20(1)26. Epigynum: insemination duct with about half a coil (Fig. 4L,M).

AN UNASSIGNED SPECIES

Heteropoda gordonensis sp.nov.
(Figs 4N-P; 5I; 19A)

TYPE MATERIAL

HOLOTYPE: ♂, Gordon Ck, Iron Range, northeastern Queensland, 12°44'S, 143°17'E, 24-30.vi.1976, VED, RJR, PF, QMS15191.

PARATYPES: ♀, same data as holotype, QMS15192; 8♂, 7♀, QMS14815; ♂, ♀, Leo Ck nr Coen, 13°33'S, 143°28'E, 1-17.viii.1978, GVC, SVD, QMS14812; 5♂, 5♀, Leo Ck nr Coen, 26.vii.1976, PF, QMS14814; 2♂, Rocky Scrub, Leo Ck Rd, 17.iii.1979, KRM, QMS14813.

ETYMOLOGY

From the type locality, Gordon Creek, Iron Range.

DIAGNOSIS

Small-medium size. Trapezoid area pale brown with 2 pale paramedial stripes. Tegulum longer than wide, without process; flange arising mid-prolaterally; embolus tapering with short blunt sub-distal branch (Fig. 4P); conductor broad with short stalk. Tibial apophysis flat, scythe-like. Very short, wide insemination ducts. Clypeus a little longer than AME.

DESCRIPTION

Male (holotype): CL 6.3, CW 5.8, AL 5.8, AW 3.5. Legs 2143. Spination: femora I-III 323, IEV 321; patellae I-IV 101; tibiae I, II 2326, III 2226, IEV 21(2)26. ♂ palp (Fig. 5I).

Female: CL 6.8, CW 6.1, AL 7.7, AW 5.1. Spination: femora I-III 323, IV 321; patellae I-IV 001; tibiae I-IV 2026. Epigynum: median septum with deep transverse bar, much shorter than lateral lobes (Fig. 4N,O).

THE *BELLENDENKER* GROUP

Small spiders. Venter mottled, legs 2413. MOQ slightly longer than wide. Clypeus a little longer than AME. Broad tegular flange giving ear-shaped appearance; without tegular process. Embolus arising postero-retrolaterally, long, filiform, thickening slightly distally to knob-like tip. Anvil-shaped tibial apophysis. Epigynum with short median septum broadening to transverse bar; insemination ducts with 1-1½ coils

Heteropoda bellendenker sp.nov., *H. mossman* sp.nov.

Heteropoda bellendenker sp.nov.
(Figs 2I; 4Q,R; 7A,B,J; 19A)

TYPE MATERIAL

HOLOTYPE: ♂, Mt Bellenden Ker, northeastern Queensland, 17°16'S, 145°51'E, 500m, 1-7.xi.1981, EWQM, QMS15193.

PARATYPES: Mt Bellenden Ker: ♀, 1054m, 25-31.x.1981, VED, EWQM, QMS14707; ♂, 500m, 17-24.x.1981, EWQM, QMS14727; 3 ♂, 1054m, 17-24.x.1981, EWQM, QMS14718; ♀, ♂, 25-31.x.1981, VED, EWQM, QMS14708; Other localities: ♀, Emerald Ck, Lamb Ra., 17°03'S, 145°32'E, 11.x.1982, GBM, DY, GT, QMS14711; 3 ♀, Mt Edith, 17°06'S, 145°37'E, 11.x.1982, GBM,

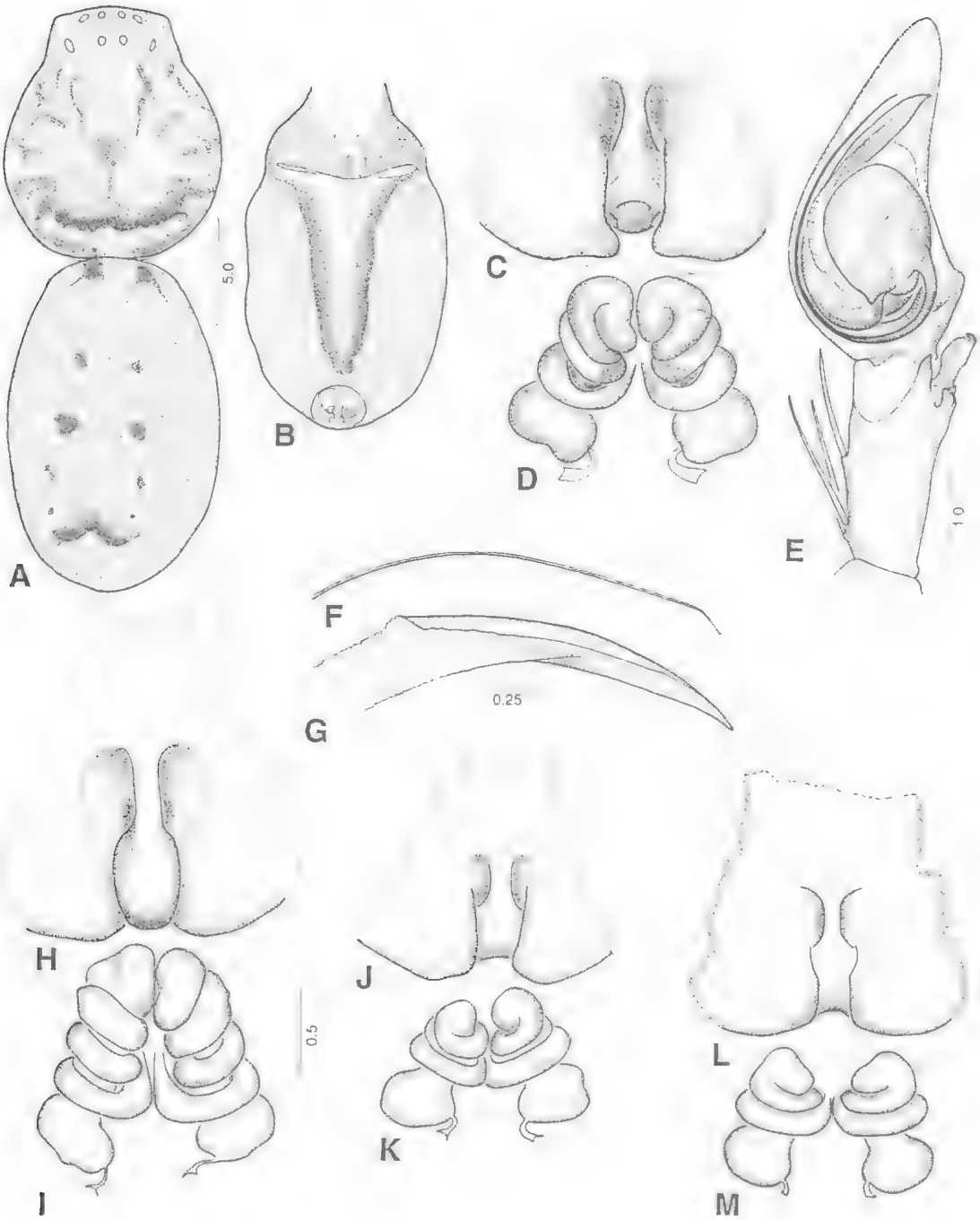

FIG. 6. A-G, *Heteropoda jugulans*; H,I, *H. alta*; J,K, *H. hillerae;* L,M, *H. cooki.* A, dorsal view; B, ventral abdomen; C,D, H-M,external and internal epigyna; E, ♂ palp; F,G, embolus and conductor.

DY, GT, QMS14704; ♀, Mt Edith, 1050m, 12.x.1982, GBM, DY, GT, QMS14716; 3 ♀, Malaan State Forest, 17°36'S, 145°36'E, 20-24.iv.1978, VED, RJR, QMS14712; 6 ♂, 2 ♀, Major's Mountain, 17°38'S, 145°32'E, 14-20.iv.1978, VED, RJR, QMS14079; ♂, 2 ♀, Mt Fisher, 17°33'S, 145°33'E, 27-29.iv.1982, GBM, DY, DC, QMS14713; ♂, Boulder Ck, via Tully, 17°52'S, 145°55'E, 500-600m, 24-27.x.1983, GBM, DY, GT, QMS14710. All in northeastern Queensland.

ETYMOLOGY

From the type locality, Mt Bellenden Ker.

DIAGNOSIS

Small. Tibial apophysis with upturned tip; sperm duct with single loop (as seen on tegulum, Fig. 2I), ♀ insemination ducts with one coil.

DESCRIPTION

Male (holotype): CL 4.9, CW 4.4, AL 5.2, AW 3.1. Dorsal abdomen with red-brown mottling with dark shoulder patches and W posteriorly. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I, II 2326, III, IV 2226. ♂ palp (Fig. 7A,B): embolus with knob-like tip (Fig. 7J); broad tegular flange giving ear-like appearance, tibial apophysis slender, curving anvil-shaped with thin, flat upturned tip.

Female: CL 5.4, CW 4.8, AL 5.4, AW 3.1. Colour: generally darker and less distinctly patterned than male. Spination: femora I-II 323, IV 321; patellae I-IV 001; tibiae I-IV 2026. Epigynum (Fig. 4Q,R): short, median septum, indented posteriorly; insemination duct with one coil.

REMARKS

H. bellendenker is found in higher altitude rainforests of northeastern Queensland. As well as the listed localities it has been collected from the Cardwell (17°48'S, 145°38'E) and Kirrama Ranges (18°06'S, 145°51'E) and from Mt Graham (18°24'S, 145°52'E).

Heteropoda mossman sp.nov.
(Figs 2H; 4S,T; 7C,D; 19A)

TYPE MATERIAL

HOLOTYPE: ♂, Bluff Track, 5-10 km W of Mossman, north Queensland, 16°28'S, 145°23'E, 760m, 20.xii.1989-15.i.1990, GBM, GT, AE, QMS21004.

PARATYPES: ♀, ♂ same data QMS21005; 3 ♂, 1000m, QMS21006; ♂, 480m, QMS21009; 2 ♂, 360m, QMS21010; ♀, 250m, QMS21011; ♂, Creek Camp, near McLeod, Windsor Tableland, 16°15'S, 145°05'E, 26-27.xii.1980, AE, QMS14717; ♀, North Bell Peak, 17°05'S, 145°53'E, 15-16.ix.1981, GBM, DC, QMS14719; ♂, Windsor Tableland, NNW of Mt Carbine, 25-26.iv.1982, GBM, DY, DC, QMS14705; ♂, 2 ♀, Mt Hartley, c. 490m, 6.xi.1974, JC, DJ, VED, QMS14706; ♀, Home Rule nr Helenvale, 15°42'S, 145°13'E, 5.xi.1974, DJ, VED, QMS14715; ♂, Mt. Finnigan, 15°49'S, 145°17'S, 980-1130m, 9.xi.1974, LR, JC, KRM, VED, QMS14714; Mt Finnigan, 14.xii.90-17.i.1991, QM/AE: ♀, 940m, QMS21013; ♀, 1060m, QMS21014; ♂, Thornton Pk, 16°05'S, 145°23'E, xi.1975, MG, AMKS8267. All in northeastern Queensland.

ETYMOLOGY

From the type locality, Mossman.

DIAGNOSIS

Small. Tibial apophysis with flat obtuse tip slightly down-turned; a second small loop in sperm duct before entering embolus (Fig. 2H). ♀ insemination ducts with 1½ coils.

DESCRIPTION

Male (holotype): CL 4.0, CW 3.6, AL 4.2, AW 2.4. Colour: similar to *H. bellendenker*. Spination: femora I-III 323, IV 321; patellae I 101, II-IV 001; tibiae I-IV 2326. ♂ palp (Fig. 7C,D): tegulum similar to *H. bellendenker*; tibial apophysis slender, flat with slightly down-turned blunt tip.

Female: CL 4.9, CW 4.4, AL 6.3, AW 4.4. Dorsal abdomen darker than male, closely mottled. Venter mottled with dark V posteriorly. Spination: femora I-III 323, IV 321; patellae I-IV 001; tibiae I-III 2026, IV 2126. Epigynum (Fig. 4S,T): similar to *H. bellendenker* but 1½ coils in insemination ducts.

THE *JUGULANS* GROUP

Small-large. Venter pattern variable. MOQ longer than wide. ♂ tegulum longer than wide; tegular flange as long as tegulum. Tegular process pointed, rounded or reduced. Tibial apophysis without 'tooth'. ♀ median septum of epigynum tongue-like shorter than lateral lobes. Insemination ducts with ½-3 coils.

Heteropoda jugulans (L. Koch) and the following new species, *H. alta*, *H. hillerae*, *H. cooki*, *H. nagarigoon*, *H. holoventris*, *H. vespersa*, *H. warrumbungle*, *H. distincta*, *H. eungella* and *H. conwayensis*.

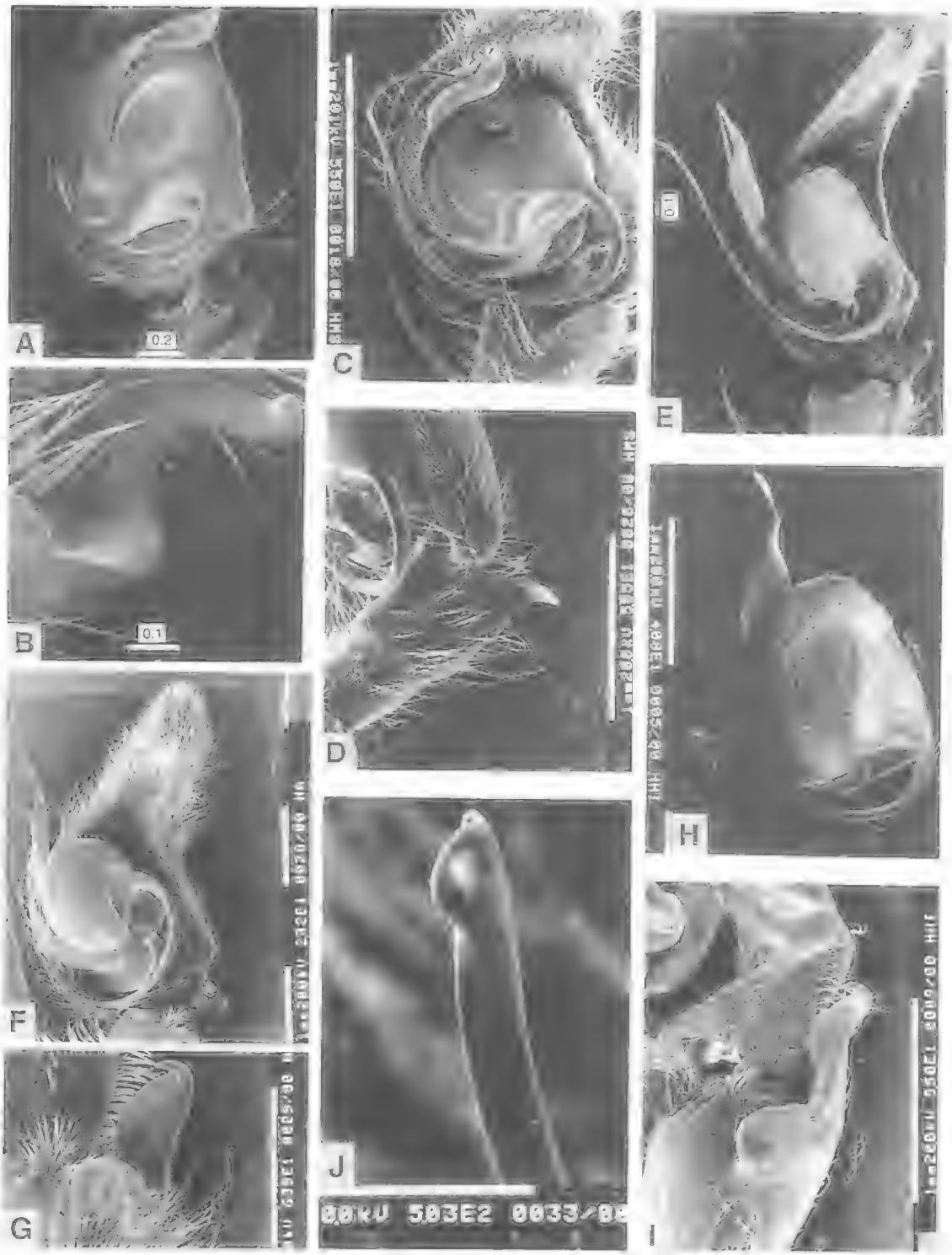

FIG. 7. A,B, J, *Heteropoda bellendenker*; C,D, *H. mosssman*; E, *H. jugulans*; F,G, *H. alta*; H,I, *H. hillerae*. A-I, ♂ palps and tibial apophyses; J, tip of embolus.

Heteropoda jugulans (L. Koch, 1876)
(Figs 1; 2C,K; 3A-I; 6A-G; 7E; 18)

Sarotes jugulans L. Koch, 1876: 852.
Heteropoda jugulans: Simon, 1880: 269; Hogg, 1902: 416; Rainbow; 1911: 240.

TYPE MATERIAL
HOLOTYPE: ♂, Peak Downs, mid-eastern Queensland 22°56'S, 148°05'E, ZMH (Godeffroy No. 14635).
PARATYPE:: ♂, Peak Downs, BMNH15.3.5.6462, Godeffroy collection.

OTHER MATERIAL
Southeastern Queensland: Brisbane, ♀, Mt Gravatt, QMS14844; ♀, Banyo, QMS14849; 2 ♂, Fig Tree Pocket, QMS14877; ♂, QMS14846; 3 ♂, Alderley, QMS14876; 2 ♂, The Gap, QMS14847; ♀, Mt Coottha, QMS14893. Mideastern Queensland: 2 ♂, Brandy Ck, QMS14848; ♀, Mt Dryander, AMKS7356. Northeastern Queensland: ♂, Shiptons Flat, QMS21018; 3 ♂, 11 ♀, QMS21019; ♀, ♂, Cape Tribulation, QMS14046; ♀, Townsville, SAMAN1990341; ♀, Hinchinbrook I., AMKS19551.

DIAGNOSIS
Large. Venter pale brown with darker V pattern, sometimes indistinct in males. Tegulum with posteriorly directed acute process; tibial apophysis broad with slightly hooked tip posteriorly. Epigynum with tongue-like median septum shorter than lateral lobes; insemination duct with 2 coils.

DESCRIPTION
Male (holotype): CL 9.3, CW 8.4, AL 9.5, AW 5.5. Venter pale with narrow faint brown V. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I, IV 2226, II, III 2326. ♂ palp (Figs 6E-G; 7E). The paratype is a little smaller with similar spination. In ♂ ♂ from Brisbane and other localities dorsal spination of tibiae IV varies from 2-3.

Female (Brisbane, Fig. 6A,B): CL 11.7, CW 10.4, AL 15.0, AW 9.6. Venter light brown with darker V pattern. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I, II 2026, III 2126, IV 2226. Epigynum (Fig. 6C,D): insemination duct with 2 coils.

REMARKS
H. jugulans has been collected from coastal forests and wet sclerophyll forests from Brisbane to Shiptons Flat, north Queensland (Fig.18). No fresh material has been collected from the type locality, Peak Downs, which is much changed through mining and grazing.

Heteropoda alta sp.nov.
(Figs 6H,I; 7F,G; 19B)

TYPE MATERIAL
HOLOTYPE: ♂, Mt Molloy, north Queensland, 16°41'S, 145°20'E, 1974, P. & F. Little, QMS21021.
PARATYPES: ♀, Bakers Blue Mt., 800-1000m, 17km W of Mt Molloy, 30.xii.1989-9.i.90, AE, QMS21022; ♀, same data, QMS21023; ♂, juvs, Mt Molloy, 1974, P. & F. Little, QMS21024; ♀, Boonjee, 17°24'S, 145°44'E, 700m, 8.xii.1988, GBM, GT, QMS15267; ♀, Douglas Ck, Lamb Ra., 17°06'S, 145°30'E, 700m, 12.x.1982, GBM, DY, GT, QMS14914; ♀, Broadwater Pk, 35km NW Ingham, 18°39'S, 146°10'E, 60m, 16.xii.1986, GBM, GT, S. Hamlet, QMS15268; ♀, 3km S Mt Spurgeon, 16°26'S, 145°12'E, 1100m, 20-21.xii.1988, GBM, GT, QMS15257; ♀, Devils Thumb Track, 16°27'S, 145°16'E, 100-600m, 26.xii.1989, AE, QMS21025; ♀, Tully, 17°57'S, 145°55'E, 17.v.1968, J. Cann, AMKS19526; ♂, ♀, Herberton, 17°23'S, 145°23'E, 1951, J.G. Brooks, AMKS19527; ♀, Babinda, 17°21'S, 145°56'E, J.G. Brooks, 1951, AMKS19536; ♀, Mt Surprise, Undara, Michaels Cave, 18°09'S, 144°19'E, 16.1.1989, F.G. Howarth, AMKS22430; ♀, Kuranda, 16°49'S, 145°38'E, 15.iii.1950, A.N. Burns, VMK-3004; 2 ♀, Longland Gap, Atherton-Herberton Rd, ix.1950, J.G. Brooks, VMK-3005-3006. All in northeastern Queensland.

ETYMOLOGY
From the Latin *altus* meaning high, referring to the high altitude.

DIAGNOSIS
Trapezoid area of venter with marked, dark V pattern. Medium septum of epigynum slightly shorter than lateral lobes; insemination ducts with 3 coils.

DESCRIPTION
Male (holotype): CL 10.2, CW 9.0, AL 9.9, AW 5.0. Dorsal abdomen pale brown with usual pattern. Spination: similar to *H. jugulans*. ♂ palp (Fig. 7F,G) very like *H. jugulans*.

Female: CL 10.4, CW 8.7, AL 13.8, AW 10.0. Trapezoid area of venter outlined in darker V band leaving pale central region. Spination: Similar to *H. jugulans*. Epigynum (Fig. 6H,I): insemination ducts longer than *H. jugulans* with 3 coils. Variation: mottling was sometimes present between the dark V on venter.

Heteropoda hillerae sp.nov.
(Figs 6J,K; 7H,I; 19B)

TYPE MATERIAL

HOLOTYPE: ♂, Mt Glorious, southeastern Queensland, 27°20'S, 152°43'E, 29.x.89, K. Hiller, QMS21026.

PARATYPES: ♀, Mt Glorious, 4.v.89, K. Hiller, QMS6905; ♀, Mt Nebo, 27°23'S, 152°47'E, 14.iii.1978, A. Hiller, QMS15035; ♀, Mt Nebo, 15.viii.1990, M.S. Harvey, T. Churchill, WAM93/1757; ♀, Mt Nebo, 10.ix.1973, C. Wallace, QMS15037; ♀, Mt Tenison Woods, 762m, 12.xi.1975-27.i.1976 GBM, SRM, QMS15030; ♀, Neurum Ck, Mt Mee, 27°02'S, 152°42'E, 20.i.-26.ii.1978, GBM, QMS15024; ♀, Glenview, 26°46'S, 153°03'E, 15.iv-27.ix.1978 GBM, SRM, QMS15028; ♀, Upper Neurum Ck, 31.x.78-13.ii.1979, GBM, SRM, QMS15025; ♀, Neurum Ck, Mt Mee, 26.vi-30.x.1978, GBM, QMS15040. All in southeastern Queensland.

ETYMOLOGY

For Katie Hiller, the collector of the holotype.

DIAGNOSIS

Medium size. Dorsal abdomen hirsute, well marked pattern; mottled venter with darker irregular V pattern posteriorly. Bluntly pointed tegular process. ♀ insemination ducts with one coil.

DESCRIPTION

Male (holotype): Cl 7.7, CW 6.7, AL 7.5, AW 4.2. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I-III 2326, IV 2226. ♂ palp (Fig. 7H,I): tegular process pointing posteriorly; tibial apophysis tapering to curved tip.

Female: CL 7.9, CW 7.3, AL 8.0, AW 5.3. Trapezoid area of venter mottled, darker V pattern. Spination: femora I-III 323, IV 321; patellae I, III, IV 001, II 101; tibiae I 2026, II-IV 20(1)26. Epigynum (Fig. 6J,K).

Heteropoda cooki sp. nov.
(Figs 6L,M; 9A; 19B)

TYPE MATERIAL

HOLOTYPE: ♂, Mt Bellenden Ker, northeastern Queensland, 17°12'S, 145°51'E, 1560m, 10.vi.1980, GBM, QMS15164.

PARATYPES: ♀, Mt Bellenden Ker, 1560m, 17-24.x.1981, EWQM, QMS15163; ♂, TV station, Mt Bellenden Ker, 1560m, 25-31.x.1981, EWQM, QMS15162; ♀, South Peak summit, Mt Bartle-Frere, 17°24'S, 145°49'E, 1620m, 6-8.xi.1981, EWQM, QMS15165; ♂, Massey Ra; 1250m, 17°16'S, 145°49'E, 9-11.x.1991, GBM, DC, HJ, QMS21027; ♂, Mt Fisher, 17°33'S, 145°33'E, 1000-1200m, 5.v.1983, GBM, DY, QMS15167; 3 ♀, Mt Fisher, 1050-1100m, 27-29.iv.1982, GMB, DY, DC, QMS15166; ♂, 3♀, Mt Spurgeon, 16°26'S, 145°13'E, 1250-1300m, 15-20.xi.1991, GBM, DC, HJ, LR, QMS21028; ♀, Mt Spurgeon, 16°22'S, 145°13'E, 1200-1250m, 17-19.x.1991, GBM, DC, HJ, LR, QMS21029. All in northeastern Queensland.

ETYMOLOGY

For Douglas Cook, a collector of many spiders from high altitudes.

DIAGNOSIS

Large. Venter pale with mottled pattern. Tegulum longer than wide with blunt process directed ventro-prolaterally. Epigynum with short median septum; insemination ducts with 1½ coils.

DESCRIPTION

Male (holotype): CL 8.9, CW 7.7, AL 9.2, AW 5.5. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I-IV 2326. ♂ palp (Fig. 9A): tibial apophysis broad, tapering to curved tip.

Female: CL 11.4, CW 10.2, AL 14.6, AW 10.0. Spination: femora I-III 323, IV 321; patellae I-III 101, IV 100; tibiae I-IV 2226. Epigynum (Fig. 6L,M): short, spade-like median septum; insemination ducts with 1½ coils.

REMARKS

H. cooki has been found only at altitudes of 1000m or more in northeastern Queensland.

Heteropoda nagarigoon sp.nov.
(Figs 8A-C; 9B; 19C)

TYPE MATERIAL

HOLOTYPE: ♂, Nagarigoon, Lamington National Park, southeastern Queensland, 28°19'S, 153°05'E, 1.iv.1976, NH, VED, QMS15200.

PARATYPES: Lamington National Park: Nagarigoon (same data), ♀, QMS15201; 2 ♂, 6 ♀, QMS14833; 2 ♂, 6 ♀, S14831; ♂, 8.iv.1976, NH, VED, QMS14828; ♀, Ballunjui Falls track, 4.iv.1976, M. Bishop, NH, QMS14830; 2 ♂, 4 ♀, Binna Burra, 27-30.iii.1976, VED, RJR, QMS14829; ♂, 13.vi.1971, M. Archer, E. Jeffreys, WAM88/1956. Other localities: 3 ♂, Mt Tamborine, 27°55'S, 153°10'E, southeastern Queensland, 10.vii.1974, VED, C.L. Wilton, RJR, QMS14832. New South Wales: ♂, near Mt Warning, 28°24'S, 153°16'E, 3.xii.1974, RJR, QMS15039; ♀,

Whian Whian State Forest, 28°38'S, 153°19'E, 9-12.ix.1976, RJR, QMS15026.

ETYMOLOGY

From the type locality Nagarigoon, Lamington National Park.

DIAGNOSIS

Medium size. Venter mottled with ill-defined trapezoid area (Fig. 8C). Tegulum produced into low rounded postero-prolateral bulge. Elongate tibial apophysis, tapering, curved at tip. Median septum of epigynum with narrow neck, broadening posteriorly; insemination duct with one coil.

DESCRIPTION

Male (holotype): CL 7.8, CW 6.7, AL 7.5, AW 4.0. Venter yellow-brown with irregular brown mottling. Spination: femora I, II 323, III 322, IV 321; patellae I-IV 101; tibiae I-IV 2226. ♂ palp (Fig. 9B). Variation: in other males dorsal spines varied on tibiae III, IV, 2(3).

Female: CL 8.5, CW 7.8, AL 9.8, AW 5.8. Spination: femora I, II 323; III 322; IV 321; patellae I-IV 001; tibiae I-III 2026, IV 2226. Epigynum (Fig. 8A,B). Variation: dorsal spination of tibiae III varied O(1) and IV 2(1).

REMARKS

Although males of *H. nagarigoon* have no marked prolateral tegular process, the low rounded projection in this area suggests it belongs in the *jugulans* group of species. The long narrow prolateral flange on the proximal tegulum supports this view.

Heteropoda holoventris sp.nov.
(Figs 8D,E; 9C,D; 19C)

TYPE MATERIAL

HOLOTYPE: ♂, Mt Bellenden Ker, northeastern Queensland 17°16'S, 145°51'E, 500m, 17-24.x.1981, EWQM, QMS15181.

PARATYPES: Mt Bellenden Ker ♀, same data, QMS15182; 3 ♀, 1-7.xi.1981, QMS14825; 2 ♀, 17-24.x.1981, EWQM, QMS15237; ♂, Twelve Mile Scrub, via Helenvale, 22-27.xi.1975, VED, RM, QMS14816; ♂, near Palmerston National Park, 22.i.1975, RJR, QMS14823; 2 ♀, Mt Finlay, 15°49'S, 145°21'E, 29.xi.-4.xii.1975, VED, RM, QMS14818; ♀, Malaan State Forest, 17°36'S, 145°36'E, 20-24.iv.1978, VED, RJR, QMS14817; 3 ♀, Home Rule, nr Helenvale, 15°42'S, 145°13'E, 5.xii.1974, JC, DJ, VED, QMS14819; ♀, Boulder Ck, via Tully, 17°52'S, 145°55'E, 500-600m, 24-27.x.1983, GBM, DY, GT, QMS14822; ♀, Yungaburra, 17°16'S, 145°35'E, 700m, 8.xii.1988, GBM, GT, QMS15265; ♀, Fritz Ck, 15°51'S, 145°22'E, xii.1975, MG, AMKS8172. All in northeastern Queensland.

ETYMOLOGY

From a combination of the Greek *holo-* meaning whole and the Latin *venter* meaning belly, referring to the pale uniform trapezoid area of the venter.

DIAGNOSIS

Large. Venter brown with distinct pale, cream-coloured trapezoid area. Small prolateral tegular process; short tibial apophysis, bifurcate tip, longer curved posterior fork. Median septum shorter than lateral lobes; insemination ducts with ½ coil.

DESCRIPTION

Male (holotype): CL 10.9, CW 9.5, AL 10.5, AW 5.4. Spination: femora I-III 323, IV 321(2); patellae I-IV 101; tibiae I-III 2326, IV 2336. ♂ palp (Fig. 9C,D)

Female: CL 10.3, CW 8.8, AL 11.3, AW 7.1. Spination: femora and patellae as in ♂; tibiae I, II 2026, III 20(1)26, IV 22(1)26. Epigynum (Fig. 8D,E).

Heteropoda vespersa sp.nov.
(Figs 8F,G; 9E,F; 19B)

TYPE MATERIAL

HOLOTYPE: ♂, 4.5-5km W of Cape Tribulation, northeastern Queensland, 16°05'S, 145°29'E, 780m, 27.ix.-7.x.1982, GBM, DY, GT, QMS15198.

PARATYPES: ♀, Thornton Peak, 16°10'S, 145°23'E, xi.1975, MG, AMKS8260; ♂, Cape Tribulation, 780m, 27.ix.-7.x.1982, GBM, DY, GT, QMS15169; ♂, same data, QMS15168. All in northeastern Queensland.

ETYMOLOGY

From the Latin *vesper* meaning evening, referring to when the spider is active.

DIAGNOSIS

Medium size. Trapezoid area of venter pale. Tegulum with rounded prolateral bulge; tibial apophysis tapering to curved tip. Median septum shorter than lateral lobes; insemination duct with 1½ coils.

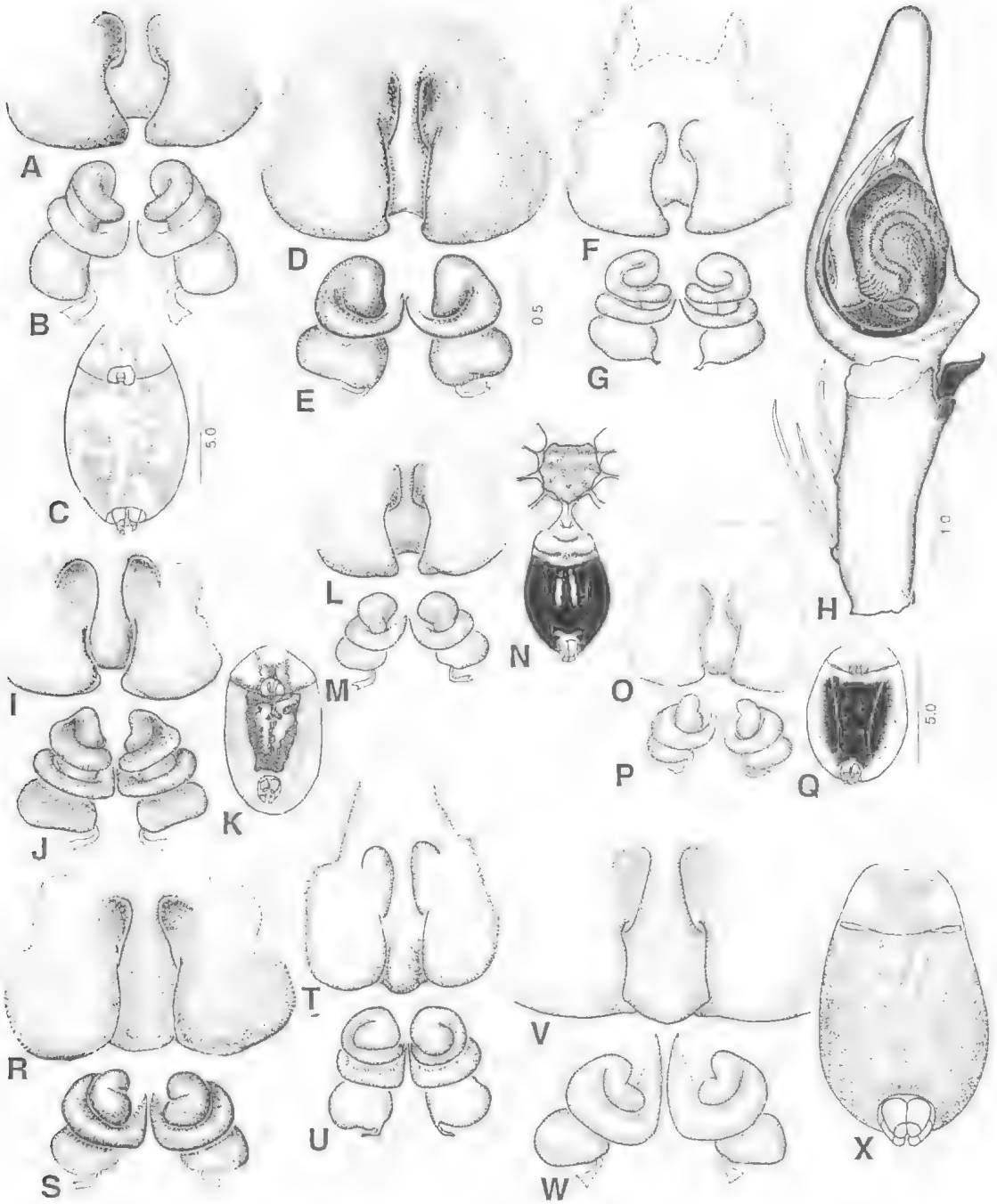

FIG. 8. A-C, *Heteropoda nagarigoon;* D,E, *H. holoventris*; F,G, *H. vespersa;* H, *H. warrumbungle*; I-K, *H. distincta*; L-N, *H. eungella*, O-Q, *H. conwayensis;* R,S, *H. goonaneman*; T,U, *H. spurgeon*; V-X, *H. bulburin*. A,B,D-G,I,J,L,M,O,P,R-W, epigyna; C,K,N,Q,X, ventral abdomen; H, ♂ palp.

FIG. 9. A, *Heteropoda cooki*; B, *H. nagarigoon*, C-D, *H. holoventris;* E,F, *H. vespersa*; G,H, *H. distincta*; I,J, *H. eungella.* A-J, ♂ palps and tibial apophyses.

DESCRIPTION

Male (holotype): CL 6.4, CW 5.9, AL 6.6, AW 4.0. Colour. Trapezoid area pallid but not so clearly defined as *H. holoventris*. Spination: femora I, II 323, III 33(2)3, IV 331; patellae I-IV 101; tibiae I, II 2326; III, IV 2226. ♂ palp (Fig. 9E,F).

Female: CL 9.5, CW 8.6, AL 9.5, AW 5.3. Spination: femora I-III 323, IV 33(4)1; patellae I-IV 101; tibiae I 2026, II 20(1)6, III 22(1)26, IV 2326. Epigynum (Fig. 8F,G).

Heteropoda warrumbungle sp.nov.
(Figs 8H; 18)

TYPE MATERIAL

HOLOTYPE: ♂, Wallumburrawang Ck, Warrumbungle Ranges, New South Wales, 31°34'S, 148°56'E, 29.iv.1988, D. Hirst, SAMAN1990327.

ETYMOLOGY

From the Warrumbungle Ranges.

DIAGNOSIS

Large spider with barred legs, tegular process rounded projection, tibial apophysis tapering to point.

DESCRIPTION

Male (holotype): CL 9.8, CW 8.5, AL 10.6, AW 5.6. Colour: trapezoid area of venter pale with slight mottling. Black spots on legs giving stripey appearance. Spination: femora I-III 3 2 3, IV 3 2 1; patellae I-IV, 1 0 1; tibiae I-IV 2 3 2 6. ♂ palp (Fig. 8H).

The female is unknown.

Heteropoda distincta sp.nov.
(Figs 8I-K; 9G,H; 19B)

TYPE MATERIAL

HOLOTYPE: ♂, Nagarigoon, Lamington National Park, south-eastern Queensland, 28°19'S, 153°05'E, 1.iv.1976, NH, VED, QMS15203.

PARATYPES: Lamington National Park: ♀, Nagarigoon, same data as holotype, QMS15204; 4 ♀, 1.iv.1976, NH, VED, QMS14777; 2 ♂, 1-8.iv.1976, M. Bishop, NH, VED QMS14782; 6 ♀, 1-8.iv.1976, VED, QMS14779; 2 ♂, 2 ♀, Ballanjui Falls track, 4.iv.1976, M. Bishop, NH, QMS14773; ♂, Binna Burra, 27-30.iii.1976, VED, RJR, QMS14781; ♂, Springbrook, 5.xii.1971, B. Baldwin, QMS14780; ♂, Mt Cainbable, 28°05'S, 153°05'E, 28.ix.1975-31.i.1976, GBM, SRM, QMS14801; 2 ♀, 13.vi.1971, M. Archer, E. Jeffreys, WAM88/1956.7. Southeastern Queensland: ♀ Beechmont, 28°08'S, 153°12'E, 26.x.-14.xii.1974, GBM, SRM, QMS14795; ♀, 22.iii.-25.v.1975, GBM, SRM, QMS14783. Mt Tamborine, 27°55'S, 153°10'E: ♀, 26.x.-14.xii.1974, GBM, SRM, QMS14792; ♀, 14.xii.1974-22.iii.1975, GBM, SRM, QMS14794; ♂ ♀, 27.vi.1980, N. Clyde Coleman, VED, RJR, QMS14775, 3 ♀, Numinbah Valley, 28°08'S, 153°14'E, 26.xii.1978-vi.1979, GBM, SRM, QMS14788; ♀, Sarabah National Park, 28°10'S, 153°07'E, 27.xi.1976-23.i.1977, 120m, GBM, SRM, QMS14786; ♀ same data, QMS14787; ♀, ♂, Canungra Ck, 27°58'S, 153°09'E, 120m, 13.viii-2.xii.1977, GBM, SRM, QMS14797; ♀, ♂, Burleigh Headland, 28°05'S, 153°27'E, 14.xii.1974-22.iii.1975, GBM, SRM, QMS14799. New South Wales: ♂, 2 ♀, Rotary Park, Lismore, 28°49'S, 153°16'E, 16.xi.-26.xii.1974, GBM, SRM, QMS14796; Stotts I., Tweed R., 28°16'S, 153°30'E: 3 ♀, 17-19.xi.1978, GVC, JC, RJR, SVD, QMS14776; ♂, same data, QMS15032; 2 ♀, QMS15034. 4 ♂, ♀, Whian Whian State Forest, 28°38'S, 153°19'E, 9-12.ix.1976, RJR, QMS14772; ♀, Richmond Gap via Grevillea, 28°27'S, 152°50'E, 1978-9, GBM, SRM, QMS15023.

DIAGNOSIS

Medium size. Venter with dark trapezoid area with two thick irregular longitudinal pale lines (Fig. 8K). Tegulum with bluntly pointed ventro-prolateral process; tibial apophysis long, tapering with curved tip. Median septum shorter than lateral lobes; insemination duct with 1½ coils.

DESCRIPTION

Male (holotype): CL 6.3, CW 5.6, AL 6.0, AW 4.1. Clear epigastrial pattern of 2 pale, irregular longitudinal bands on red-brown base. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I, II, IV 2326, III 2426. ♂ palp (Fig. 9G,H): tegular process, sub-acute, ventrally directed with secondary 'peak'. Variation: ♂ ♂ paratypes with 3 dorsal spines on tibiae III.

Female: CL 7.5, CW 6.7, AL 7.2, AW 4.9. Spinaton: femora I-III 323, IV 321; patellae I-IV 101; tibiae I, II 2026, III 21(0)26, IV 2226. Epigynum (Fig. 8I-J).

REMARKS

H. distincta differs from sympatric *H. nagarigoon* in the pattern on epigastrium, its distinct venter pattern (though this is not always clear in newly moulted specimens) and the sub-acute tegular process.

FIG. 10. A,B, *Heteropoda conwayensis*; C,D, *H. monroei;* E,F, *H. goonaneman*; G,H, *H. bulburin*; I, *H. acuta*. A-I, ♂ palps and tibial apophyses.

Heteropoda eungella sp.nov.
(Figs 8L-N; 9I,J; 19A)

TYPE MATERIAL
HOLOTYPE: ♂, Mt William, Eungella National Park, mideastern Queensland, 21°01'S, 148°36'E, 17-24.iii.1975, MG, CH, AMKS7379.
PARATYPE: ♀, Creek bank near school-house, Eungella National Park, mideastern Queensland, 13.ii.1986, RJR, JG, QMS21031.

ETYMOLOGY
From the type locality, Eungella National Park.

DIAGNOSIS
Medium size. Sternum with pattern (Fig. 8N). Venter black, with pale lateral lines of spots/stripes and two short thick paramedial stripes. Tegulum rounded prolaterally, long tegular flange. Median septum narrow, broadening suddenly to transverse bar; insemination ducts with one coil.

DESCRIPTION
Male (holotype): CL 7.0, CW 6.2, AL 6.5, AW 3.9. Spination: femora I 32(3)3, II, III 323, IV 321; patella, I, III, IV 001, II 101; tibiae I, II 2326, III 2126, IV 2226. ♂ palp (Fig. 9I,J): tibial apophysis tapering to incurved tip.
Female: CL 7.3, CW 6.5, AL 8.5, AW 4.8. Spination: femora I-III 323, IV 321; patellae I-IV 001; tibiae I-IV 2026. Epigynum (Fig. 8L,M).

REMARKS
This species is known only from rainforests at about 1000m at Eungella, mideastern Queensland.

Heteropoda conwayensis sp.nov.
(Figs 8O-Q; 10A,B; 19A)

TYPE MATERIAL
HOLOTYPE: ♂, Cape Hillsborough National Park, mideastern Queensland, 20°54'S, 149°03'E, 5.i.1975, KRM, QMS15189.
PARATYPES: ♀, same data QMS15190; 2 ♀, QMS14764. 2 ♀ Brandy Ck, 20°20'S, 148°38'E, 21-26.iv.1975, RM, VED, QMS14763. 2 ♀, ♂ Conway National Park, 20°21'S, 148°48'E, 22.i.1975, KRM, QMS14765; 2 ♀, 13.ii.1975, KRM, S14766. ♀, in log, Mt Dryander, 20°15'S, 148°32'E, 21-26.iv.1975, MG, CH, AMKS7355. All in mideastern Queensland.

ETYMOLOGY
From the locality, Conway National Park.

DIAGNOSIS
Small. Sternum without pattern. Venter with dark trapezoid area delimited by pale lateral bands (Fig. 8Q); two sub-central lines of 2-7 white tufts of setae. Long tegular flange, no tegular process. Median septum short, gradually broadening to thick transverse bar; insemination ducts with ½ coil.

DESCRIPTION
Male (holotype): CL 5.7, CW 5.3, AL 5.5, AW 3.3. Colour: venter with dark shield, extending beyond the trapezoid area. Spination: femora I-III 323, IV 321; patellae I-III 001, IV 101; tibiae I-IV 2226. ♂ palp (Fig. 10A,B): long tapering tibial apophysis with curved tip.
Female: CL 6.2, CW 5.7, AL 7.1, AW 4.6. Colour pattern: similar to male but less distinct. Spination: femora I, II 323, III 322(3), IV 321; patellae I-III 000, IV 001; tibiae I 1026, II, III 2026, IV 20(1)26. Epigynum (Fig. 8O,P).

REMARKS
H. conwayensis appears to be a coastal rainforest species. It may be distinguished from *H. eungella* by venter and sternal patterns and by shorter insemination ducts in female.

THE *CERVINA* GROUP

Small-large. MOQ longer than wide. Venter pattern variable. Tegulum longer than wide (exc. *H. monroei*), tegular flange as long as tegulum. Pointed tegular process (exc. *H. monroei*). Tibial apophysis with 'tooth'. ♀ median septum of epigynum tongue-like, as long as or more usually longer than lateral lobes. Insemination ducts with ½-3 coils.
Heteropoda cervina (L. Koch) and the following new species, *H. monroei, H. goonaneman, H. spurgeon, H. bulburin, H. acuta, H. willunga, H. rundle, H. monteithi, H. crediton, H. silvatica* and *H. cooloola.*

Heteropoda monroei sp.nov.
(Figs 10C,D; 18)

TYPE MATERIAL
HOLOTYPE: ♂, Homevale, mid-eastern Queensland, 21°27'S, 148°32'E, campsite, 1-7.iv.1975, VED, RM, QMS15175.

ETYMOLOGY
For Ronald Monroe, co-collector of the holotype.

DIAGNOSIS

Small. Tegulum wider than long with postero-prolateral bulge without pointed tegular process; tibial apophysis with large thorn-like 'tooth'.

DESCRIPTION

Male (holotype): CL 6.3, CW 5.8, AL 7.0, AW 4.0. Colour: slight mottling on venter, short, dark V posteriorly. Spination: femora I-III 323, IV 321; patellae I, III, IV 101, II 001; tibiae I-III 2226, IV 22(1)26. ♂ palp (Fig. 10C,D): ratio of cymbium length: length from anterior rim of alveolus to tip is 1:0.6.

The female is unknown.

REMARKS

H. monroei is placed in the *cervina* group because of the tooth on tibial apophysis. It is the only species in the group without a pointed tegular process.

Heteropoda goonaneman sp.nov.
(Figs 8R,S; 10E,F; 19C)

TYPE MATERIAL

HOLOTYPE: ♂, Mt Goonaneman, via Childers, southeastern Queensland, 25°26'S, 152°08'E, 670m, 3-6.xi.1980, VED, RJR, QMS15185.

PARATYPES: ♀, ♂, Amamoor Ck, 26°22'S, 152°37'E, 29.xi.1975-29.ii.1976, GBM, SRM, QMS14809; ♂, Casey Ck, via Imbil, 10.viii.-9.xi.1974, GBM, SRM, QMS14811; ♂, ♀, Cold Ck, via Imbil, 9.xi.-31.xii.1974, GBM, SRM, QMS14810; ♀, Mt Goonaneman, 3-4.xi.1980, VED, RJR, QMS15186, 3 ♂, 5 ♀, same data QMS15214; ♀, 13.xii.1976-31.iii.1977, GBM, SRM, QMS14808; ♀, Brooyar State Forest, 26°01'S, 152°24'E, 17.iv.1982, AR, D. Sinclair, QMS14806; ♀, 23.viii.1975-29.ii.1976, 457m, GBM, SRM, QMS14721; ♀, Mt Bauple, 25°47'S, 152°34'E, 26.viii-9.xii.19716, GBM, SRM. QMS14720. All in southeastern Queensland.

ETYMOLOGY

From the type locality, Mt Goonaneman.

DIAGNOSIS

Large. Venter without discernible pattern. Short ventro-prolateral tegular process; tibial apophysis broad, truncated with tooth on posterior corner. Medium septum almost as long as lateral lobes; insemination duct with one coil.

DESCRIPTION

Male (holotype): CL 8.3, CW 7.8, AL 8.9, AW 5.1. Colour: faint brown mottling. Spination: femora I-III 323, IV 321; patellae I-III 101, IV 001; tibiae I 3326, II, III 2326, IV 2226. ♂ palp (Fig. 10E,F).

Female: CL 10.6, CW 9.1, AL 15.1, AW 9.7. Spination: femora I, II 323, III 322, IV 321; patellae I, II, IV 001, III 101; tibiae I 2026, II-IV 2126. Epigynum (Fig. 8R,S).

Heteropoda spurgeon sp.nov.
(Figs 8T,U; 19C)

TYPE MATERIAL

HOLOTYPE: ♀, 4km NNE Mt Spurgeon, north Queensland, 16°24'S, 145°13'E, 15-20.x.1991, 1250-1300m, GBM, DC, HJ, LR, QMS21032.

PARATYPES: ♀, 2km SE Mt Spurgeon via Mt Carbine, 16°26'S, 145°13'E, 1100m, 20-21.xii.1988, GBM, GT, QMS16532; ♀, Pauls Luck, Platypus Ck, 13km W Mossman, 16°27'S, 145°15'E, 1100m, 1-2.i.1990, AE, QMS21033; ♀, 2km ESE Mossman Bluff, 16°27'S, 145°17'E, 1000m, 17-19.xii.1988, GBM, GT, QMS15266; ♀, Mt Formartine South, 16°47'S, 145°38'E, 700m, 23-24.xi.1990, GBM, GT, QMS21034. All in northeastern Queensland.

ETYMOLOGY

From the type locality Mt Spurgeon.

DIAGNOSIS

Large. Trapezoid area of venter pale brown with posterior mottling. Median septum of epigynum broad, as long as lateral lobes, rounded distally.

DESCRIPTION

Female (holotype): CL 9.6, CW 8.6, AL 12.0, AW 8.4. Colour: short pale cardiac stripe, paired dark abdominal spots faint, posterior dark W-shaped patch of hair. Spination: femora I-III 323, IV 321; patellae I-III 101, IV 000; tibiae I-IV 2026. Epigynum (Fig. 8T,U): median septum as long as lateral lobes; insemination duct with 1½ coils. Variation: abdominal pattern clear in paratypes.

The male is unknown.

Heteropoda bulburin sp.nov.
(Figs 8V-X; 10G,H; 19C)

TYPE MATERIAL

HOLOTYPE: ♂, Bulburin State Forest, mid-eastern Queensland, 24°31'S, 151°29'E, complex notophyll rainforest with *Araucaria* emergents, 17-24.iii.1975, RK, VED, QMS14724.

PARATYPES: Bulburin State Forest: ♀, same data as holotype QMS21035; ♀, QMS14722; ♂, QMS14726; ♀, 25-8.iii.1977, RJR, VED, QMS14725; ♀, 17-24.iii.1975, MG, CH, AMKS6779.

ETYMOLOGY

From the type locality, Bulburin State Forest.

DIAGNOSIS

Large. Trapezoid area of venter pale and mottled (Fig. 8X). Tegular process directed prolaterally. Tibial apophysis indented at tip with tooth on shorter posterior fork. Insemination ducts with ½ coil.

DESCRIPTION

Male (holotype): CL 9.7, CW 8.5, AL 10.0, AW 5.9. Colour: trapezoid area defined by pale lateral lines. Spination: femora I-III 323, IV 321; patellae I-IV, 101; tibiae I-III 2326, IV 2226. ♂ palp (Fig. 10G,H).

Female: CL 10.4, CW 9.2, AL 12.7, AW 8,8. Spination: femora I-III 323, IV 321; patellae I, II 001, III, IV 101; tibiae I-III 2126, IV 2226. Epigynum (Fig. 8V,W): broad median septum level with posterior edge of lateral lobes.

REMARKS

H. bulburin is closely allied to *H. goonaneman* from which it may be distinguished by the distal indentation of ♂ tibial apophysis and shorter ♀ insemination ducts.

Heteropoda acuta sp.nov.
(Figs 11A-C; 10I; 19C)

TYPE MATERIAL

HOLOTYPE: ♂, Wallaby Ck, near Helenvale, north eastern Queensland, 15°44'S, 145°15'E, 15.xi.1974, JC, KRM, DJ, VED, QMS15183.

PARATYPES: ♀, same data as holotype, QMS15184; ♂, 6 ♀, Wallaby and Granite Cks, 11.xi.1974, JC, KRM, DJ, VED, QMS14695; 2 ♂, QMS14696; ♀, JC, T. Tebble, VED, QMS14697. Mt Bellenden Ker, 17°16'S, 145°51'E: ♂, 1054m, 17-24.x.1981, EWQM, QMS14701; 2 ♀, 500m, 17-24.x.1981, EWQM, VED, QMS14700; 2 ♀, Mt Finnigan, 15°49'S, 145°17'E, 850-1100m, 19-22.iv.1982, GBM, DY, DC, QMS14702; ♂, same data, QMS14703; ♂, ♀, Twelve Mile Scrub, 15°48'S, 145°19'E, 22-27.xi.1975, VED, RM, QMS14698; 3 ♀, Mt Finlay, 15°49'S, 145°21'E, 29.xi.-4.xii.1975, VED, RM, QMS14698. All in north-eastern Queensland.

ETYMOLOGY

From the Latin *acutus* meaning pointed, referring to the sharply pointed tegular process.

DIAGNOSIS

Large. Venter slightly mottled. Tegular process pointing prolaterally; tibial apophysis rounded distally with sub-distal tooth on posterior edge. Median septum narrowed distally extending beyond lateral lobes; insemination duct tight ½ coil.

DESCRIPTION

Male (holotype): CL 7.9, CW 7.1, AL 7.9, AW 5.1. Spination: femora I-III 323, IV 3(4)21; patellae I, II, 101, III, IV 001; tibiae I-III 2326, IV 2226. ♂ palp (Fig. 10I).

Female: CL 11.1, CW 9.8, AL 11.9, AW 7.9. Colour: less distinct than in male. Spination: femora I-III 323, IV 321; patellae I, II 001, III, IV 000; tibiae I-IV 2026. Epigynum (Fig. 11A,B): long broad median septum ending in a knob.

REMARKS

The long median septum distinguishes *H. acuta* from females of other species (*H. holoventris*, *H. cooki*) in this area and the toothed tibial apophysis distinguishes it from other males.

Heteropoda cervina (L. Koch, 1875)
(Figs 2L; 11D-F; 12A,B; 19B)

Sarotes cervinus Koch, 1875: 673; 1876: 854.

Heteropoda cervina: Simon, 1880: 270; Hogg, 1902: 416; Jarvi, 1914: 76, 200.

Heteropoda keyserlingi Hogg, 1902: 418 - new synonymy.

TYPE MATERIAL

LECTOTYPE: ♂, Peak Downs, 22°56'S, 148°05'E, mideastern Queensland, Amalie Dietrich, ZMH - here designated.

PARALECTOTYPES: 2 ♀, Peak Downs, BMNH 1890.7.1.3095, 3096; 2 ♀, ♂, Bowen, 20°01'S, 148°15'E, mideastern Queensland, BMNH 6457-6459, Koch Coll.; ♀, Rockhampton, 23°22'S, 150°32'E, mideastern Queensland, ZMH (Godeffroy No. 11010).

OTHER MATERIAL

2 ♀ syntypes of *Heteropoda keyserlingi*, Peak Downs, BMNH; 2 ♂, Yeppoon, QDPI Ar378; 3 ♀, Homevale, nr Nebo, QMS14728; ♂, Rockhampton, QMS21036;

♀, Emu Park, Rockhampton, QMS14730. All in mideastern Queensland.

DIAGNOSIS

Medium-large size. Venter with dark trapezoid area with two pale converging lines. Tegulum with pointed ventro-prolateral tegular process; long, paddle-shaped tibial apophysis with a mound on central anterior edge; a triangular thorn-like fold ('tooth') centrally (Fig. 12A,B). Median septum of epigynum extending beyond lateral lobes, terminally rounded, length:width, 1:0.3; insemination ducts with 1½ coils.

DESCRIPTION

Male (lectotype): CL 8.0, CW 7.3, AL 7.9, AW 4.3. This matches in size the male described and illustrated in Koch (1875). Colour: abdominal pattern faded, venter with black trapezoid area with poorly defined pale converging lines. Spination: femora I, II 323, III 322, IV 321; patellae I-IV 101; tibiae I-IV 2326. ♂ palp (Fig. 11F): embolus not reaching end of conductor.

Female (paralectotype): CL 8.0, AL 6.6, AL 11.2, AW 7.5. Colour: faded, similar to male. Spination: femora I, II 323, III 322, IV 321: patellae I, II, IV 101, III 001; tibiae I-III 2026, IV 2226. Epigynum (Fig. 11D,E). Variation: ♀ from Bowen has a tighter apical fold in insemination ducts and variable tibial spination. 3♀ from Homevale are larger and have 2 dorsal spines on tibiae III.

REMARKS

The type locality, Peak Downs is much changed with depletion of forest habitat due to mining (including smelting) and latterly grazing. No fresh material has been collected from here. 2♀ syntypes, *Sarotes cervinus* Koch, Port Mackay, ZMB (Godeffroy No.3453) are considered to be *H. crediton* sp.nov. *Heteropoda cervina* is closely related to *H. willunga* sp.nov. and *H. rundle* sp.nov.

Heteropoda willunga sp.nov.
(Figs 11G,H; 12C; 19B)

TYPE MATERIAL

HOLOTYPE: ♂, Forty Mile Scrub, 18°05'S, 144°53'E, SW of Mt Garnet, northeastern Queensland, 9-14.iv.1978, VED, RJR, QM QMS15239.

PARATYPES: 2 ♂, same data as holotype, QMS15170; ♀, same data as holotype, QMS15240.

ETYMOLOGY

From willunga, an Aboriginal word meaning 'dry vine scrub'.

DIAGNOSIS

Large. Trapezoid area with two converging lines of closely spaced pale dots. Tegulum with prolaterally directed process; tibial apophysis with large medial tooth. Broad median septum; ratio of length:width is 1:0.4; insemination ducts with one coil.

DESCRIPTION

Male (holotype): CL 8.2, CW 8.1, AL 9.2, AW 4.9. Colour: venter with brown trapezoid area and 2 lines of pale dots. Spination: femora: I-III, 323, IV 321; patellae I-IV 101; tibiae I-III 2326, IV 2226. ♂ palp (Fig. 12C) very like *H. cervina*.

Female: CL 9.6, CW 8.7, AL 11.7, AW 7.7. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I 2026, II, IV 2126, III 2226. Epigynum (Fig. 11G,H).

REMARKS

H. willunga may be distinguished from *H. cervina* by the broader median septum and one coil, rather than 1½ coils, in the insemination duct.

Heteropoda rundle sp. nov.
(Figs 11I,J; 12D; 19B)

TYPE MATERIAL

HOLOTYPE: ♂, Rundle Range, mideastern Queensland, 23°40'S, 151°00'E, 24-31.iii.1975, VED, RK, QMS14738.

PARATYPES: Mideastern Queensland: ♀, same data as holotype, QMS21000; 2 ♂, QMS21185; Kroombit Tops, 24°22'S, 151°00'E: 2 ♀, 2 ♂, 14.xii.1983, R. Leggat, QMS14729; 2 ♀, 22-26.ii.1982, RJR, QMS14735; ♂, 9-19.xii.1983, VED, JG, QMS14753; ♀, 3-4.ii.1984, GBM, DY, C. Hagan, QMS14740; ♂, 13-18.xii.1983, VED, JG, QMS14752; ♀, 9-19.xii.1983, GBM, GT, QMS14733; ♀, Bulburin Plateau, 24°31'S, 151°29'E, 5.x-30.xii.1974, GBM, SRM, QMS14736. Southeastern Queensland: ♂, Coalstoun Lakes, 25°37'S, 151°53'E, 25km SW Biggenden, 26.iii-5.ix.1977, GBM, SRM, QMS14739; 2 ♂, Burnett Ra., 15km NE Tansey, 26°03'S, 152°03'E, 1976-77, GBM, SRM, QMS14744; ♂, same data, QMS14747; 2 ♂, Gallangowan, 26°26'S, 152°17'E, 26.iii-16.vi.1975, GBM, SRM, QMS14750.

ETYMOLOGY

From the type locality, Rundle Range.

DIAGNOSIS

Medium size. Tegulum with prolaterally directed process; tibial apophysis with central tooth. Tip of median septum rounded but not knob-like; insemination ducts with 2 coils.

DESCRIPTION

Male (holotype): CL 7.2, CW 6.7, AL 7.5, AW 4.4. Colour: venter like *H. cervina*. Spination: femora I-III 323, IV 321; patellae I-IV 001; tibiae I, II 2326, III, IV 2226. ♂ palp (Fig. 12D); embolus reaching almost to end of conductor.

Female: CL 7.8, CW 7.3, AL 9.6, AW 6.3. Spination: femora I-III 323, III 321; patellae I-III 001, IV 101; tibiae I-III 2026; IV 2226. Epigynum (Fig. 11I,J).

REMARKS

H. rundle is closely related to *H. cervina* but may be distinguished by 2 (rather than 3) dorsal spines on ♂ tibiae III, IV. The tip of the median septum is not knoblike as in *cervina* and insemination ducts have 2 rather than 1½ coils.

Heteropoda monteithi sp.nov.
(Figs 11K,L; 12F,G; 19C)

TYPE MATERIAL

HOLOTYPE: ♂, Yandaburra, 125km SW Springsure, central Queensland, 24°42'S, 147°30'E, 7.v.1976, C. Fearnley, QMS15177.

PARATYPES: ♀, Mt Moffat Nat. Pk, central Queensland, 25°01'S, 147°57'E, Mahogany Forest, 1000m, 11-12.xii.1987, GBM, GT, DY, QMS14472; ♀ same data, QMS14478; ♀, same locality, 12.xii.1987, DY, QMS14474; ♂, Lake Nuga Nuga, nr Rolleston, central Queensland, 25°01'S, 148°42'E, 10.v.1978, KMD, QMS15176.

ETYMOLOGY

For Geoffrey Monteith, whose collections from mountain tops in Queensland figure prominently in this revision.

DIAGNOSIS

Medium size. Tegulum almost as wide as long, pointed postero-prolateral process; tooth on tibial apophysis forward of posterior edge; proximal mound on anterior edge. Median septum longer than lateral lobes; insemination duct with 3 coils.

DESCRIPTION

Male (holotype): CL 7.3, CW 6.4, AL 7.9, AW 4.4. Colour: trapezoid area of venter brown, paler in centre, slight evidence of 2 pale lines of dots, darker V posteriorly. Spination: femora I, II 323, III 322, IV 321; patellae I-IV 101; tibiae I-IV 2226. ♂ palp (Fig. 12F,G).

Female: CL 7.3, CW 6.7, AL 7.5, AW 4.5. Colour: trapezoid area of venter dark brown; two lines of pale spots merging anteriorly to give pale central region. Spination: femora I, II 323, III 322, IV 321; patellae I-III 001, IV 101; tibiae I-III 2026, IV 21(2)26. Epigynum (Fig. 11K,L).

Heteropoda crediton sp.nov.
(Figs 11P-R; 12H,I; 19C)

TYPE MATERIAL

HOLOTYPE: ♂, Crediton, mideastern Queensland, 21°13'S, 148°33'E, complex notophyll vine forest, 14-21.iv.1975, RK, VED, QMS15208.

PARATYPES: ♀, same data as holotype, QMS15209; ♀, ♂, QMS14916; ♂, QMS15211; 4 ♂, ♀, Homevale, 21°27'S, 148°32'E, riverine forest, 1-7.iv.1975, RK, VED, QMS15210; ♂, Dalrymple Heights, nr Eungella, 21°08'S, 148°30'E, 1000m, 7-14.iv.1975, MG, CH, AMKS7341; 3 ♂, Dalrymple Heights, 7-14.iv.1975, MG, CH, AMKS7340; 2 ♂, 4 ♀, Finch Hatton, 21°07'S, 148°38'E, 7-14.iv.1975, RK, VED, QMS15213; ♂, same data, QMS14919; ♀, Eungella National Park, 21°10'S, 148°24'E, 2.ii.1975, KRM, QMS14915; 2 ♀, Eungella National Park, 3.iii.1975, KRM, QMS14912; 2 ♂, Broken River, Eungella National Park, 21°12'S, 148°33'E, 4-5.ix.1988, JG, T. Churchill, QMS13849; ♀, Dalrymple Hgts, 21°08S, 148°30'E, iii-iv.1975, MG, CH, AMKS0294; 3 ♂, same data, AMKS7340; ♂, AMKS7341. All in mideastern Queensland.

ETYMOLOGY

From the type locality, Crediton.

DIAGNOSIS

Large. Venter with brown trapezoid area with two pale stripes (Fig. 11R), sometimes indistinct. Long tegular process pointing posteriorly; tibial apophysis rounded with sub-apical posterior tooth, sperm duct with small coil before entering embolus. Median septum as long as lateral lobes; insemination ducts with 3 coils.

DESCRIPTION

Male (holotype): CL 9.8, CW 9.2, AL 10.0, AW 5.4. Colour: light brown venter, darker trapezoid area with two pale stripes. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I, II, IV 2226, III 2326. ♂ palp (Fig. 12H,I).

Female: CL 10.0, CW 9.6, AL 13.1, AW 8.1. Colour: similar to male. Spination: femora I-III

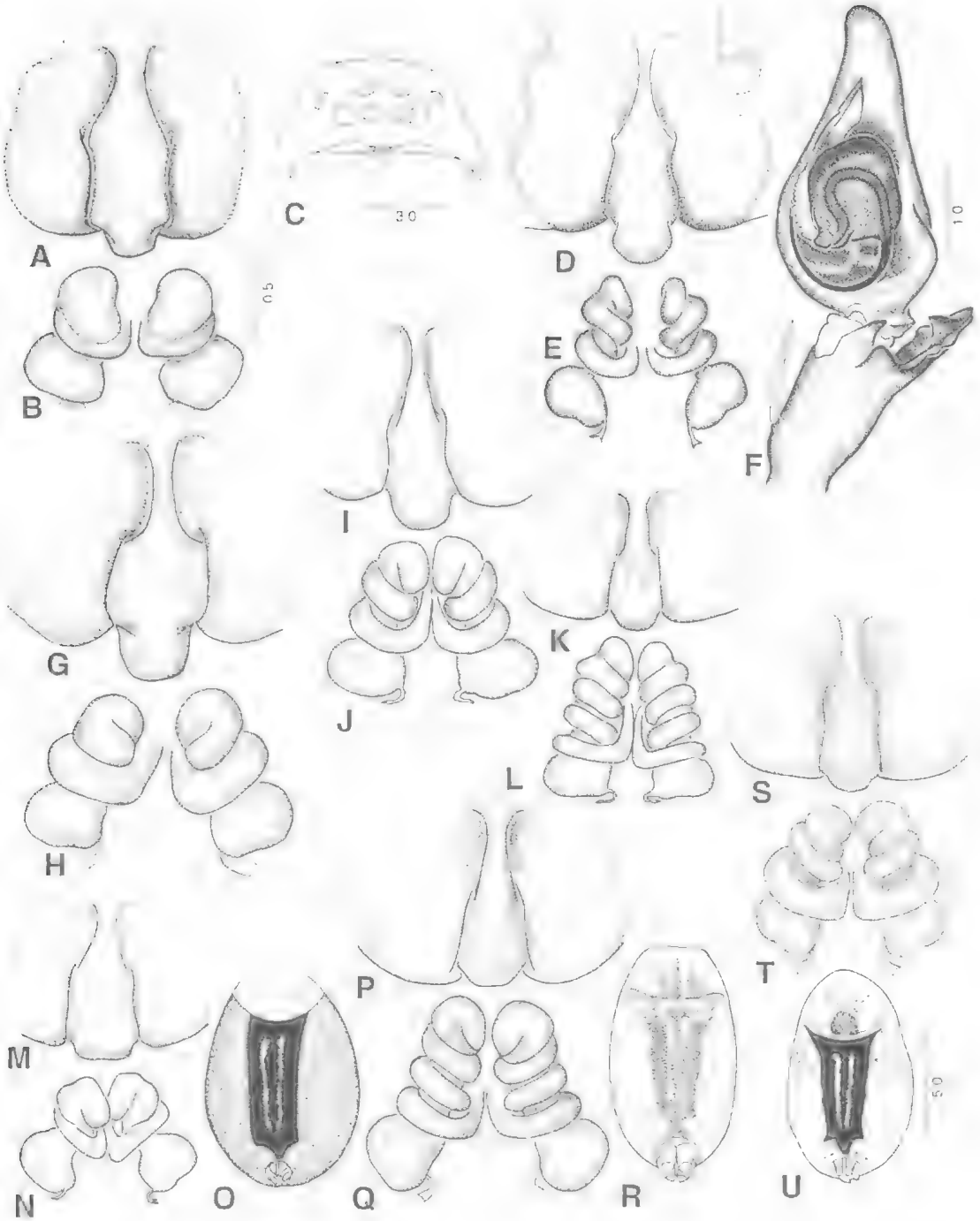

FIG. 11. A-C, *Heteropoda acuta*; D-F, *H. cervina* (F, lectotype); G,H, *H. willunga*; I,J, *H. rundle*; K,L, *H. monteithi*; M-O, *H. cooloola*; P-R, *H. crediton*; S-U, *H. silvatica*. A,B,D,E,G-N,P,Q,S,T, epigyna; C, eyes from front; F, ♂ palp; O,R,U, ventral abdomen.

FIG. 12. A,B, *Heteropoda cervina*; C, *H. willunga*; D, *H. rundle*; E, *H. silvatica*; F,G, *H. monteithi*; H,I, *H. crediton*. A-I, ♂ palps and tibial apophyses.

323, IV 321; patellae I-IV 101; tibiae I, II 2026, III 2126, IV 2226. Epigynum (Fig. 11P,Q).

REMARKS

2 ♀ syntypes of *Sarotes cervinus* Koch, Port Mackay, ZMB (Godeffroy No. 3453) are considered to be *H. crediton*.

Heteropoda silvatica sp.nov.
(Figs 11S-U; 12E; 19C)

TYPE MATERIAL

HOLOTYPE: ♂, Gold Creek Reservoir, Brookfield, southeastern Queensland, 27°27'S, 152°52'E, complex notophyll vine forest with *Araucaria* emergents, 30.x.-14.xi.1980, VED, RJR, QMS15127.

PARATYPES: ♀, Gold Creek Reservoir, Brookfield, 22.i.81, VED, RJR, QMS15128; ♂, Upper Brookfield, 27°29'S, 152°52'E, 5.x.-11.xi.1981, RJR, QMS15131; ♀, Upper Brookfield, 28.xi.-11.xii.1980, VED, RJR, QMS15130; ♂, Mt Nebo, 27°23'S, 152°47'E, 2.xii.1979, GI, QMS15132; ♀, Brookfield, 110m, 9.xi.1975-27.ii.1976, GBM, SRM, QMS15134; ♀, Kenmore, Brisbane, viii.1971, J. Hodge, QMS15129; ♀, Mt Nebo, 19.xii.1972, D. Dale, QMS15133; ♂, Flinton Hill via Ipswich, 27°31'S, 152°44'E, 120m, 9.xi.1975-27.ii.1976, GBM, SRM, QMS15138; ♂, Casey Ck via Imbil, 26°28'S, 152°41'E, 27.iii-16.vi.1975, GBM, SRM, QMS15136; 2 ♀, ♂, Elgin Vale, 30km NE Nanango, 26°27'S, 152°12'E, 610m, 17.x-12.xii.1976, GBM, SRM, QMS15140; ♀, Elgin Vale, 26.iii-28.x.1977, GBM, SRM, QMS15137; ♀, Deer Reserve via Kilcoy, 26°57'S, 152°34'E, 19.ix.1974-11.i.1975, 457m, GBM, SRM, QMS14751; ♀, Neurum Valley, 27°02'S, 152°42'E, GBM, SRM, QMS14741; ♂, Yarraman State Forest, 26°51'S, 151°59'E, 4.vii.1982, AR, QMS14745; ♀, Camira, Brisbane, 3.iv.90, RJR, QMS12537. All in southeastern Queensland.

ETYMOLOGY

From the Latin *silva*, meaning forest, referring to the forest habitat.

DIAGNOSIS

Medium size. Tegulum about as wide as long; process pointing posteriorly; tibial apophysis rounded with tooth inside posterior margin. Median septum longer than lateral lobes; insemination ducts with two loose coils and tight apical fold.

DESCRIPTION

Male (holotype): CL 6.5, CW 6.1, AL 6.3, AW 4.3. Colour: venter pale brown, mottled; trapezoid area brown-black with series of small pale spots forming two lines (Fig. 11U). Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I-IV 2326. ♂ palp (Fig. 12E). Variation: males from Imbil, Nanango and Elgin Vale have two dorsal spines on tibiae III, IV.

Female: CL 6.5, CW 6.1, AL 9.6, AW 5.4. Spination: femora I, II 323, III 322, IV 321; patellae I-III 001, IV 101; tibiae I-III 2026, IV 2226. Epigynum (Fig. 11S,T).

Heteropoda cooloola sp.nov.
(Figs 11M-O; 14A,B; 19B)

TYPE MATERIAL

HOLOTYPE: ♂, Searys Scrub, Cooloola National Park, southeastern Queensland, 26°08'S, 153°03'E, in complex notophyll rainforest on sand, 3-8.ii.1976, VED, RJR, QMS15206.

PARATYPES: ♀, QMS15207; ♀, Searys Scrub, Cooloola National Park, 3-8.ii.1976, VED, RJR, QMS14762; ♂, Fraser I, 25°33'S, 152°59'E, 19.x.1977, T. Schaeffer, QMS14760; 2 ♀, Camp Milo, Cooloola National Park, 3-8.ii.1976, VED, RJR, QMS14759; ♂, Teewah Ck, Cooloola, 13.vii.1973, RJR, QMS14761. All in southeastern Queensland.

ETYMOLOGY

From the type locality, Cooloola National Park.

DIAGNOSIS

Medium size. Venter with well defined trapezoid area with two pale lines (Fig. 11O). Tegulum longer than wide; tegular process acute, pointing ventro-posteriorly. Median septum longer than lateral lobes; insemination ducts with one coil and loose apical fold.

DESCRIPTION

Male (holotype): CL 7.7, CW 6.6, AL 7.2, AW 4.4. Spination: femora I-III 323, IEV 321(2); patellae I-IV 101; tibiae I-III 2326, IV 2226. ♂ palp (Fig. 14A,B): tibial apophysis broad, spathulate, mound on anterior edge and tooth midway on posterior margin.

Female: CL 7.2, CW 6.2, AL 11.9, AW 8.0. Spination: femora I-III 323, IV 321; patellae I, II, IV 101, III 001; tibiae I, II 2026, III 20(1)26, IV 22226. Epigynum (Fig. 11M,N).

AN UNASSIGNED SPECIES

Heteropoda raveni sp.nov.
(Figs 13A-C; 19C)

TYPE MATERIAL
HOLOTYPE: ♀, Gordon Ck, Iron Ra., northeastern Queensland, 12°44'S, 143°17'E, 24-30.vi.1976, RJR, VED, QMS14805.
PARATYPES: 3 ♀, same data, QMS21187; ♀, Iron Ra., 1-17.viii.1978, GVC, SVD, QMS14804.

ETYMOLOGY
For Robert Raven, my colleague and co-collector of many spiders.

DIAGNOSIS
Large with dark cross-bars on legs. Pale venter. MOQ as wide as long. Clypeus more than x2 AME (Fig. 13C) cf. *H. acuta* (Fig. 11C). Narrow ridge to halfway down median septum; insemination ducts ½ coil.

DESCRIPTION
Female (holotype): CL 11.3, CW 10.0, AL 12.3, AW 7.5. Eyes: both rows recurved from top - AR straight from front. Legs: 2413. Spination: femora I-III 323, IV 331; patellae I-III 001, IV 101; tibiae I, II 2026, III 2126, IV 2226. Epigynum (Fig. 13A,B): pale, lightly sclerotized insemination duct with half a coil; spermathecae without obvious prolateral bulge (cf. *hermitis* group). Variation: dorsal tibial spination of III, IV was variable in other females.
The male is unknown.

REMARKS
H. raveni resembles the *hermitis* group in having a ridge on the median septum. However along with other differences the structure of the internal epigynum is so different from the many coils of the *hermitis* group, that *raveni* is unassigned to a group; the discovery of a male may resolve its placement.

THE *HERMITIS* GROUP

Medium-sized to large spiders. Pattern on dorsal abdomen not always clearly defined, venter pale. Legs, 2143 or 21=43. MOQ slightly longer than wide. Embolus arising anteriorly or mid-retrolaterally on tegulum, almost encircling it to lie on outside of conductor. Longitudinal ridge on median septum of epigynum; 3½-7 coils in insemination duct; lobed spermathecae.

Heteropoda hermitis (Hogg) and the following new species, *H. marillana, H. spenceri, H. cavernicola, H. renibulbis, H. kalbarri*, and *H. grooteeylandi*.

Heteropoda marillana sp.nov.
(Figs 2M; 13F; 18)

TYPE MATERIAL
HOLOTYPE: ♂, Marillana Station, Western Australia, 22°38'S, 119°24'E, 15.vii.1964, A.M. Douglas, WAM88/1948.

ETYMOLOGY
From the type locality, Marillana Station.

DIAGNOSIS
The front row of eyes is slightly procurved. Tibial apophysis with tapering hook on posterior edge.

DESCRIPTION
Male: CL 8.8, CW 8.0, AL 9.4, AW 5.6. Eyes: AME:ALE:PME:PLE is 20:45:30:50. AME small, on mound, AR slightly procurved from top, strongly procurved from front, PR recurved. Clypeus more than x2 AME. Leg spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I-III 2326, IV 22(3)26. ♂ palp (Fig. 13F): ratio of cymbium length: cymbial tip is 1:0.6; tegulum rounded; tegular flange retrolateral. Embolus very long, filiform, arising anteriorly and encircling tegulum. Tibial apophysis rectangular with distal tapering hook on posterior edge.
The female is unknown.

REMARKS
H. marillana is the only species that has a slightly procurved anterior row of eyes. The small AME on a tubercle probably result in the slight procurvature of the AR and longer than usual clypeus.

Heteropoda spenceri sp.nov.
(Figs 13D,E; 18)

TYPE MATERIAL
HOLOTYPE: ♀, Barrow Ck, Northern Territory, 21°32'S, 133°53'E, 1902, Spencer and Gillen Expedition, VMK-3003.

ETYMOLOGY
For Sir Baldwin Spencer who led the expedition during which this spider was collected.

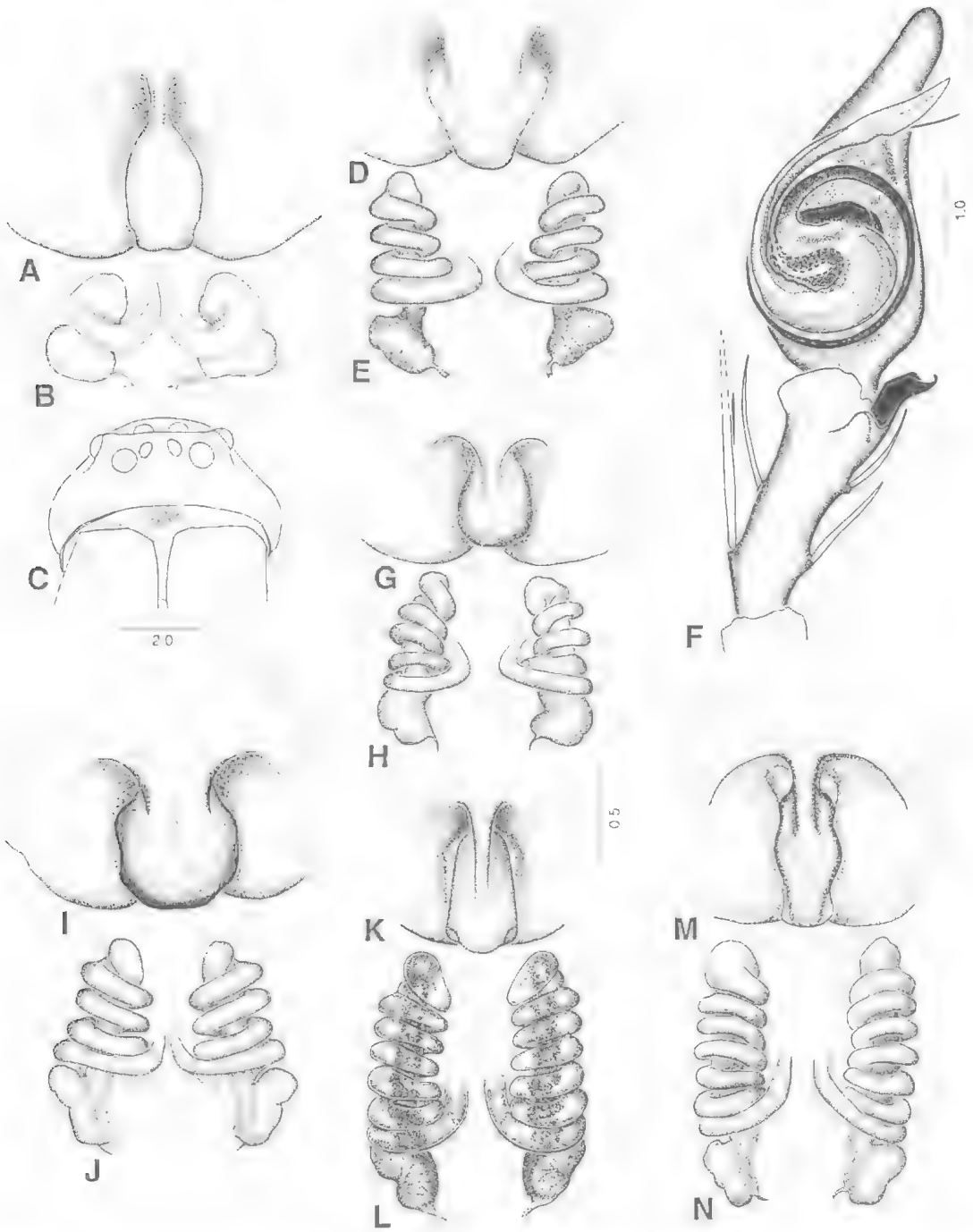

FIG. 13. A-C, *Hcteropoda raveni*; D,E, *H. spenceri*; F, *H. marillana*; G,H, *H. cavernicola*; I,J, *H. hermitis*; K-N, *H. renibulbis* (K,L, Aurukun, Queensland; M,N, Alligator R., Northern Territory). A,B,D,E,G-N, epigyna; C, eyes from front; F, ♂ palp.

DIAGNOSIS

Medium size. Median septum of epigynum heart-shaped narrowing posteriorly, as long as lateral lobes.

DESCRIPTION

Female: CL 8.0, CW 7.4, AL 9.4, AW 6.2. Spination: femora and patellae as in *marillana*, tibiae I-IV 2226. Epigynum (Fig. 13D,E): ridge on median septum is broad and short, poorly delineated. Insemination ducts with 3½ coils, spermathecae with antero-prolateral lobe.

The male is unknown.

Heteropoda hermitis (Hogg) comb. nov.
(Figs 13I,J; 14C,D; 18)

Olios hermitis Hogg, 1914: 85.

TYPE MATERIAL

SYNTYPES: 3 juvenile ♀♀ *Olios hermitis*, Hermite I., Montebello Islands, Western Australia, 20°28'S, 115°31'E, not examined.

OTHER MATERIAL

Western Australia: ♂, Barrow I., 20°46'S, 115°24'E, 10.ii.1977, H. Heatwole, W.H. Butler, WAM88/1940; ♀ Lowendal I., 20°39'S, 115°34E, iii.1985, W.H. Butler, WAM88/1947; ♂ Woodstock Stn, 21°36'S, 118°58'E, 2.v.1988, J. Dell, WAM90/1170.

DIAGNOSIS

Large. Embolus arising antero-retrolaterally giving tegulum a kidney shape. Median septum of epigynum rounded distally; insemination duct with 3½ coils.

DESCRIPTION

Male: CL 7.8, CW 7.0, AL 7.5, AW 4.5. Eyes: AR slightly recurved, PR recurved. Ratio AME:ALE:PME:PLE is 22:33:25:36. Legs: 21=43, Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I-IV 2226. Long setae on metatarsus II. ♂ palp (Fig. 14C,D): ratios of cymbium length: cymbial tip is 1:0.4. Long, tapering conductor, tegular flange short. Tibial apophysis directed forwards tapering to a point, almost parallel to axis of cymbium.

Female: CL 10.7, CW 9.4, AL 11.2, AW 7.0. Eyes and leg spination similar to male. Epigynum (Fig. 13I,J): broad, rounded median septum, as long as lateral lobes; insemination ducts with 3½ coils, spermathecae bilobed.

Heteropoda cavernicola sp.nov.
(Figs 13G,H; 18)

TYPE MATERIAL

HOLOTYPE: ♀, Napier Range, entrance chamber of Old Napier Cave, Western Australia, 17°14'S, 124°41'E, 9.vii.1966, A.M. Douglas, G.W. Kendrick, WAM74/119.

ETYMOLOGY

From the Latin *caverna* meaning a cave.

DIAGNOSIS

Large. Median septum of epigynum oval, shorter than lateral lobes, insemination ducts with 3½ coils.

DESCRIPTION

Female: CL 9.6, CW 8.6, AL 10.5, AW 6.6. Leg spination: several legs are missing, tibiae III, IV 2226, similar to *H. hermitis*. Epigynum (Fig. 13G,H): median septum shorter than lateral lobes otherwise like *H. hermitis* with 3½ coils in insemination ducts and bilobed spermathecae.

The male is unknown.

Heteropoda renibulbis sp.nov.
(Figs 2J; 13K-N; 14E,F; 18)

TYPE MATERIAL

HOLOTYPE: ♂, West Alligator R. mouth, Northern Territory, 12°15'S, 132°16'E, 22-24.vii.1979, GBM, DC, QMS15235.

PARATYPES: Northern Territory: ♂, Gorge NE of Mt Gilruth, 13°02'S, 133°05'E, 10-13.vii.1979, GBM, DC, QMS15119; ♀, Kemp Airstrip (rainforest) 12°34'S, 131°19'E, 24-25.vii.1979, GBM, DC, QMS15120, 2 ♀, Kemp Airstrip, 15-16.xi.1979, RJR, QMS15114; ♂, North Point, Kapalga, 12°36'S, 132°25'E, 19.vii.1979, GBM, DC, QMS15113; ♂, Radon Ck, 14-16.x.1979, GBM, DC, QMS15121; ♀, Radon Ck, 14.xi.1979, RJR, QMS15122; ♂, South Alligator Inn, 7-9.vii.1979, GBM, DC, QMS15111; 2 ♀, same locality, xi.1979, RJR, QMS15112; ♂, West Alligator R. mouth, 12°15'S, 132°15'E, 20-22.vii.1979, GBM, DC, QMS15117; ♀, same locality, 22-24.vii.1979, GBM, DC, QMS15236; 4 ♀, West Alligator Mouth, xi.1979, RJR, QMS15116; ♀, Darwin, 12°27'S, 130°15'E, 22.viii.1963, F. Cosmos, WAM88/1959; ♀, Darwin, 1969, A.D. Smith, WAM88/1960; ♀, ♂, Kakadu, 17.viii.1980, H. Parnaby, AMKS19553; ♀, same data, AMKS20471; ♀, Daly R., G.C. Chapman, A.E. Shaw, 1913, VMK3007. Western Australia: 2 ♀, Wotjulum Mission, via Derby, 17°19'S, 123°38'E, x.1955, A. Douglas, WAM88/927,

88/928; Northeastern Queensland: ♀, Aurukun, 13°21'S, 141°44'S, Cape York Peninsula, xi.1978, GJI, QMS15241; 2 ♀, Aurukun, xi.1978, GJI, QMS15115; ♂, Normanby Stn. via Cooktown, iii.1985, D. Bell, QMS15123. Torres Strait: ♀, Horn I., 10°37'S, 142°17'E, 24-27.i.1975, RJR, QMS15125; ♀, Badu I., 10°07'S, 142°07'E, 20.xii.1976, H. Heatwole et al., QMS15124.

OTHER MATERIAL
♀ (fragments), rainforest site 11/1, SW Osborne I., 14°23'S, 125°57'E, vi.1988, B.Y. Main, BYM 1988/K759.

ETYMOLOGY
From the Latin *ren* meaning kidney and *bulbis* meaning swelling, referring to the kidney-shaped tegulum of the ♂ palp.

DIAGNOSIS
Large. Elongate cymbium. Kidney-shaped tegulum; embolus arising antero-retrolaterally; tegular flange short, broad, postero-retrolateral. Median septum of epigynum longer than wide, ridge running about half length of septum, insemination ducts with 6-7 coils.

DESCRIPTION
Male: CL 11.3, CW 10.4, AL 12.2, AW 6.2. Legs 2143. Spination: femora I-III 323, IV 321, patellae I-IV 101, tibiae I-II 2226, III, IV 2126. ♂ palp (Fig. 14E,F): ratio of length of cymbium: cymbial tip is 1:0.5; tibial apophysis broad, bluntly pointed, almost parallel to axis of cymbium.
Female: CL 11.5, CW 10.6, AL 15.5, AW 9.7. Spination: similar to male without dorsal spines on tibiae I, II 2026. Epigynum (Fig. 13K-N): median septum as long as lateral lobes; insemination ducts with 6½ coils.

REMARKS
The females from Aurukun differ in having 6 coils in insemination ducts; the male from Cape York Peninsula is similar to *renibulbis*. Females from the Torres Strait vary from 5-7 coils in insemination ducts; no males have been collected from these localities.

Heteropoda kalbarri sp.nov.
(Figs 15A,B; 18)

TYPE MATERIAL
HOLOTYPE: ♀, Kalbarri National Park, Western Australia, 27°48'S, 114°28'E, 12-17.i.1969, Kalbarri Survey, WAM88/1945.

PARATYPE: ♀ Wal-Arrie Pool, Western Australia, 25°47'S, 115°58'E, 7.v.1989, D. Knowles, WAM90/827.

ETYMOLOGY
From the type locality, Kalbarri National Park.

DIAGNOSIS
Large. Median septum of epigynum broadening in middle.

DESCRIPTION
Female: CL 12.5, CW 11.0. Abdomen damaged. Spination: femora I-III 323, IV 322; patellae I-IV 101; tibiae I, II 2026, III, IV 2226. Epigynum (Fig. 15A,B): longitudinal ridge along length of median septum, insemination ducts with 5 coils, spermathecae bi-lobed.
The male is unknown.

Heteropoda grooteeylandt sp.nov.
(Figs 13H; 15C; 18)

TYPE MATERIAL
HOLOTYPE: ♀, Groote Eylandt, Gulf of Carpentaria, Northern Territory, 14°06'S, 136°28'E, 4.i.1929, Rev. Warren, AMKS19630.

ETYMOLOGY
From the type locality, Groote Eylandt.

DIAGNOSIS
Large. Median septum of epigynum longer than lateral lobes; ridge running length of septum.

DESCRIPTION
Female: CL 13.1, CW 10.7, AL 14.0, AW 8.0. Spination: femora I-III 323, IV 321; patellae I-IV 101, tibiae I-III 2026; IV 2126. Epigynum (Fig. 15C,D): median septum truncated with ridge running almost length of septum; insemination ducts with 5 coils; spermathecae roughly tri-lobed.
The male is unknown.

Yiinthi gen.nov.

ETYMOLOGY
Yiinthi is the Aboriginal word for a large brown ground-living spider in the Lochhart region of Cape York Peninsula, northern Queensland. The genus is feminine.

TYPE SPECIES
Yiinthi spathula sp.nov.

DIAGNOSIS

Carapace with pale cephalic region, in some females limited to a pale line from fovea to eye group. Dorsal abdomen with pale, cardiac region. MOQ slightly longer than wide. Postero-retrolateral area of ♂ cymbium usually extended posteriorly and slightly concave ventrally. Long, thick embolic structure with 'pars pendula' and sub-terminal flagellum (see arrow in Fig. 14G). Conductor arising mid-prolaterally, spoon-shaped distally. Without tegular process. Tibial apophysis digitiform, with or without projection on anterior edge. Wide short ♀ insemination ducts; loosely looped, elongate spermathecae.

DESCRIPTION

General colour pattern similar to *Heteropoda*. Thoracic region of carapace pale orange-brown centrally, darker laterally. Dark crescent-shaped area around posterior end of fovea; pale band posterior to this. Three pairs of dark spots with chevron-shaped posterior marking (cf. broad W marking of *Heteropoda*). Venter with or without pattern. Legs laterigrade, 2143, 21=43 or 2413. Scopula on all metatarsi amd tarsi, thinning proximally on metatarsi III, IV.

KEY TO *YIINTHI* SPP.

1. Small, medium or large spiders. Brown trapezoid area of venter with two pale bands laterally and two pale lines paramedially. Simple entrance to ♀ insemination ducts (Fig. 15L) ..... *spathula* group 2

   Small. Trapezoid area of venter pale, with or without mottling. Chitinous intucking at entrance to ♀ insemination ducts (Fig. 17J ... *kakadu* group 6

2. ♂ embolus with obvious *pars pendula* (Fig. 15I); post-flagellar portion curved, pointed or blunt. ♀ median septum long with small transverse bar 3

   ♂ embolus with reduced *pars pendula* (Fig. 17K); post-flagellar portion short, straight; pointed. ♀ median septum, short, with deep tongue-like bar 5

3. Pre-flagellar embolus smooth-edged (Fig. 15M). Tibial apophysis with pointed projection on anterior edge. Epigynal fossae oval in shape (Fig. 15K) 4

   Pre-flagellar embolus with sinuous, flanged edge. Tibial apophysis with rounded projection on anterior edge (Fig. 14H). Epigynal fossae inverted pear-shape (Fig. 15G) ..... *lycodes*

4. Medium size. Long embolic flagellum; post-flagellar embolus curved and pointed (Fig. 15M). ♀ insemination duct with small dorsal lobe (Fig. 4D) ..... *spathula*

   Large. Short embolic flagellum; post-flagellar embolus straight, blunt (Fig. 17C). ♀ insemination duct with large dorsal lobe (Fig. 17B) ..... *chillagoe*

5. Large. Post-flagellar portion of embolus very short (Fig. 17K). ♂ tibial apophysis with small pointed process on anterior edge. Three dorsal spines on ♂ tibiae (♀ not known) ..... *molloyensis*

   Small. Post-flagellum portion of embolus short, pointed (Fig. 17G). ♂ tibial apophysis with pointed spur on anterior edge (Fig. 17H). Two dorsal spines on ♂ tibiae ..... *anzsesorum*

6. Thick, smooth, tapering ♂ embolus with long tapering spiral flagellum (Fig. 16E). ♀ median septum with short transverse bar (Fig. 17I) ..... *kakadu*

   Very broad embolus with short, straight flagellum; pars pendula well-developed (Fig. 16I). ♀ median septum with broad transverse bar, anchor-shaped (Fig. 17M,O) 7

7. ♀ insemination ducts with lateral lobe (Fig. 17N) ..... *gallonae*

   ♀ insemination duct without lateral lobe (Fig. 17P) (♂ not known) ..... *torresiana*

THE *SPATHULA* GROUP

Medium to large spiders. Venter with brown trapezoid area with two pale bands laterally and two discontinuous lines para-medially. Projection on anterior edge of ♂ tibial apophysis. Epigynum without chitinous intucking at gonopores.

Yiinthi spathula sp.nov., *Y. lycodes* (Thorell), and the new species *Y. chillagoe, Y. molloyensis,* and *Y. anzsesorum.*

Yiinthi lycodes (Thorell, 1881) comb.nov.
(Figs 14G,H; 15E-J; 20)

Heteropoda lycodes Thorell, 1881: 282, 697.

FIG. 14. A,B, *Heteropoda cooloola*; C,D, *H. hermitis*; E,F, *H. rembulbus*; G,H, *Yiinthi lycodes*; (G, arrow to flagellum); I,J, *Y. spathula*. A-J, ♂ palps and tibial apophyses.

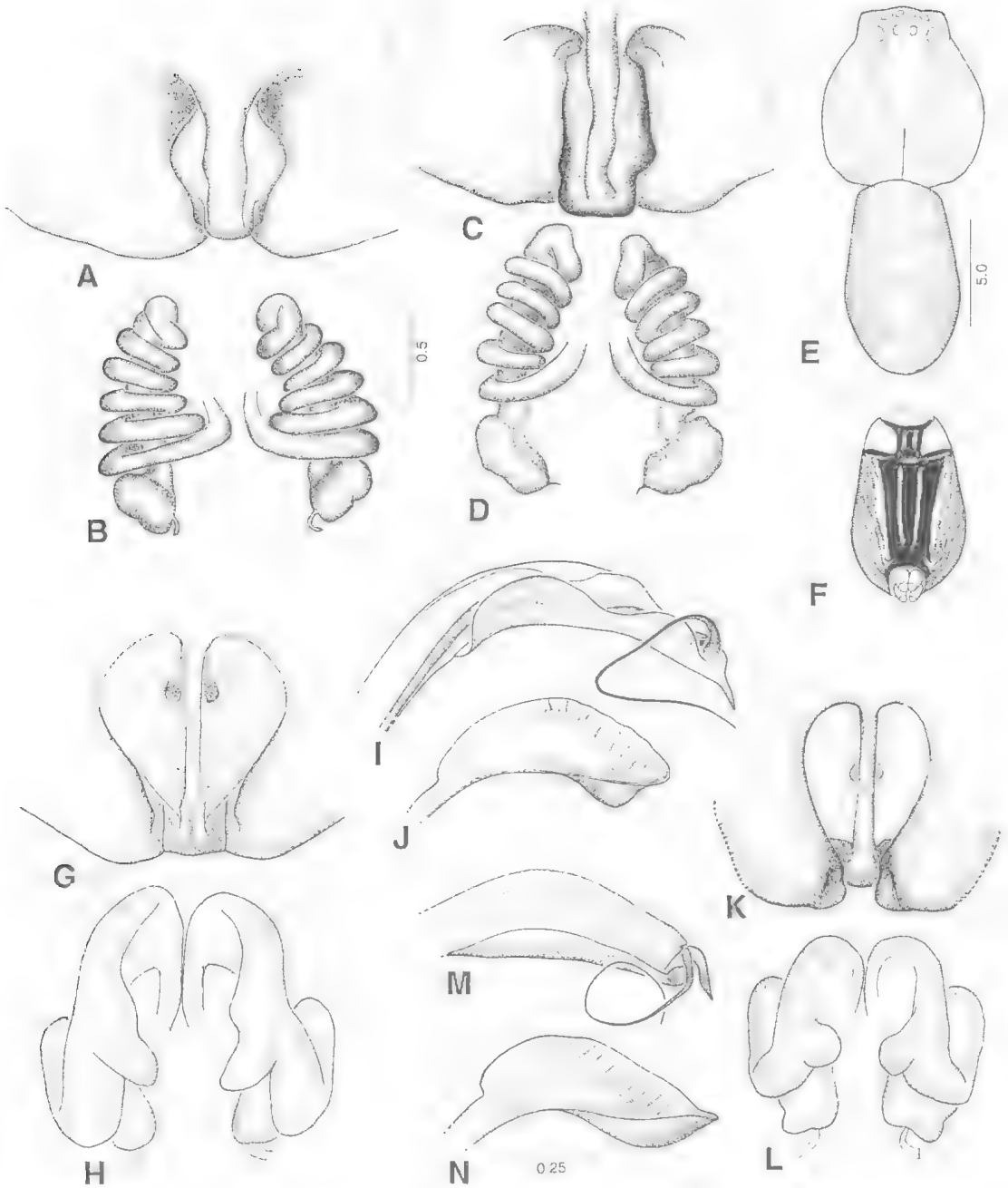

FIG. 15. A,B, *Heteropoda kalbarri*; C,D, *H. grooteeylandt*; E-J, *Yünthi lycodes*; K-N, *Y. spathula*. A-D,G,H,K,L, epigyna; E, dorsal; F, ventral abdomen; I,J,M,N, emboli and conductors.

Heteropoda fusciventris Chrysanthus, 1965; 366, figs. 52-58, 65 - new synonymy.

TYPE MATERIAL

SYNTYPES: ♂, 2 juv., Somerset, Cape York, 10°45'S, 142°35'E, L.M. D'Albertis, MCZ.

OTHER MATERIAL

Holotype ♀, allotype, ♂, 5 ♀, 8 ♂, Merauke, Irian Jaya, 8°30'S, 140°22'E, 1956/1957, Br. Monulf, RMNH (types of *Heteropoda fusciventris*); ♂, Lockerbie Scrub, QMS14992; 2 ♀, same data, QMS15000; ♂, 4 juv. QMS14989; ♂, Lake Boronto, QMS14984; ♀, Bamaga, QM 14991; ♀, Bamaga, QMS12493; ♀, Jardine R., QMS15002; ♂, Dulhunty R., QMS14988; 6 ♀, campsite Gordon Ck, Iron Ra., QMS14974; 3♀, 3♂, QMS14975; 2♀, QMS21194; ♂, ♂, Iron Ra., prey of *Poecilothomisus speciosus*, QMS15143; 1 ♂, Portland Roads, QMS14994; 2 ♀, Weatherstation Ck, QMS15003; ♂, Silver Plains, QMS15004; ♀, Cape Flattery, QMS21190; ♀, Cooktown, QMS14987; 3 ♂, 5 ♀, Mt Cook, QMS14990; 1 ♂, 8 ♀, egg sac, same data, QMS14979; ♀, Amos Bay, QMS14998; 2 ♀, QMS14985; Home Rule: QMS14983; 2 ♂, 2 ♀, QMS14986; ♂, 5 ♀, QMS14980; 9 ♂, 5 ♀, Shiptons Flat, QMS14977; 4 ♂, 6 ♀, Gap Ck, Twelve Mile Scrub, QMS14981. All in northern Queensland.

DIAGNOSIS

Medium-sized spiders. Pre-flagellar portion of ♂ embolus sinuous; embolic tip almost straight; tibial apophysis with rounded projection on anterior edge. Inverted pear-shaped fossae on either side of ♀ median septum.

DESCRIPTION

Male (syntype): CL 8.00, CS 6.7, AL 7.3, AW 4.7. Colour: carapace faded (Fig. 15E); abdomen dorsally brown with lighter-coloured median band; venter (Fig. 15F) brown, with dark brown trapezoid area with two converging white lines enclosed by light lateral bands; epigastric region with brown rectangular area and two elongate oval white areas. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I-III 2226, IV 2126. ♂ palp (Figs 14G,H; 15I,J): postero-retrolateral area of cymbium hollowed with rounded lateral projection. Tegulum a little longer than wide; distal spoon-shaped region of conductor with concavity facing cymbium. Tibial apophysis with rounded projection on anterior edge.

Female: CL 8.5, CS 8.1, AL 10.9, AW 6.3. Spination: femora I-II 323, III-IV 321; patellae I-IV 001; tibiae I-IV 2026. Epigynum (Fig 15G,H): Long, narrow median septum, inverted pear-shaped fossae; wide insemination ducts with lobe at junction of S-shaped spermathecae. The females vary in size.

REMARKS

Y. lycodes is widely distributed in North Queensland and is sympatric with *Y. spathula* at Iron Ra. It also occurs in Irian Jaya.

Yiinthi spathula sp.nov.
(Figs 2D; 14I,J; 15K-N; 20)

TYPE MATERIAL

HOLOTYPE. ♂, Gordon Ck, Iron Range, northeastern Queensland, 12°44'S, 143°17'E, 23-30.vi.1976, VED, RJR, QMS15187.

PARATYPES: Iron Range: ♀, Gordon Ck, QMS15188, 15 ♂, 25 ♀, 23-30.vi.1976, VED, RJR, QMS14973; 2 ♀, egg sac, 24.vi.1976, VED, RJR, QMS15144; ♀, 28.vi.1976, RJR, QMS15146; ♂, 1-17.viii.1978, GVC, SVD, QMS15141. ♀, Lamond Hill, summit, 12°43'S, 143°18'E, VED, RJR, QMS15145; ♀ ♂, VED, RJR, QMS15142; ♀, Claudie R, xi.1913-ii.1914, J.A. Kershaw, VM.

ETYMOLOGY

From the Latin *spatha* meaning a spoon, referring to the spoon-shaped conductor of the ♂ palp.

DIAGNOSIS

Medium-sized. Pre-flagellar portion of embolus smooth-edged; embolic tip curved; tibial apophysis with pointed projection on anterior edge. Oval-shaped fossae on either side of ♀ median septum.

DESCRIPTION

Male (holotype): CL 7.6, CW 6.6, AL 6.9, AW 4.3. Spination: femora I-III 323, IEV 321; patellae I-IV 101; tibiae I-III 2226, IEV 2126. ♂ palp (Figs 14I,J; 15M,N): postero-retrolateral area of cymbium, flattened with small triangular projection laterally.

Female: CL 8.45, CW 7.4, AL 10.6, AW 7.7. Spination: femora I-III 323, IV 321; patellae I-IV 001; tibiae I-III 2026, IV 2126. Epigynum (Fig. 15K,L): long narrow median septum, oval fossae; wide insemination ducts with dorsal lobe at junction with looped, sac-like spermathecae. The females vary in size.

REMARKS

Y. spathula has been collected only from mesophyll vine forest from Iron Ra. in far northeastern Queensland. The shapes of ♀ fossae and

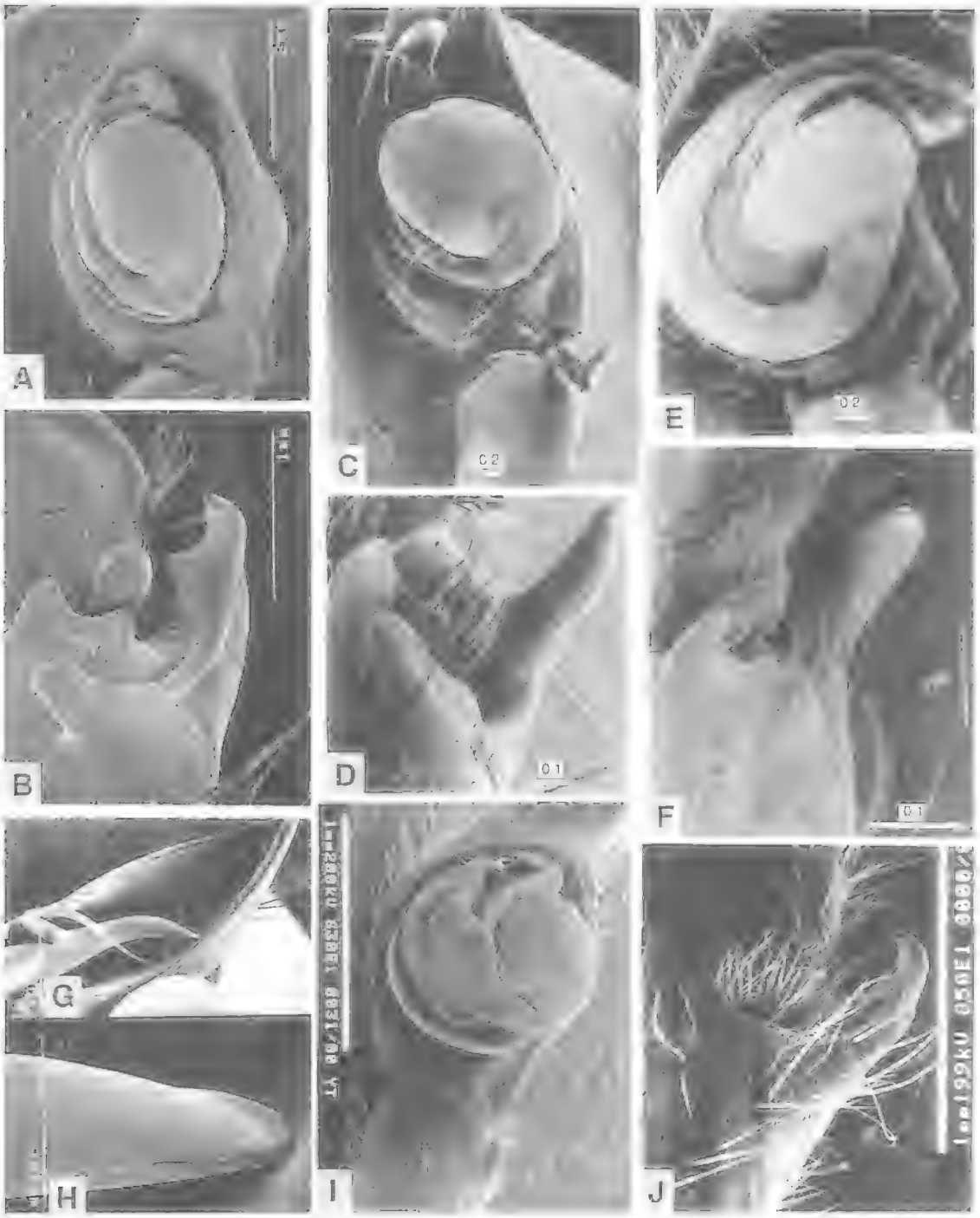

FIG. 16. A,B,G,H, *Yiinthi chillagoe;* C,D, *Y. molloyensis* (flagellum broken); E,F, *Y. kakadu*; I,J, *Y. gallonae* A-F,I,J, ♂ palps and tibial apophyses; G, tip of embolus and conductor; H, tip of embolus.

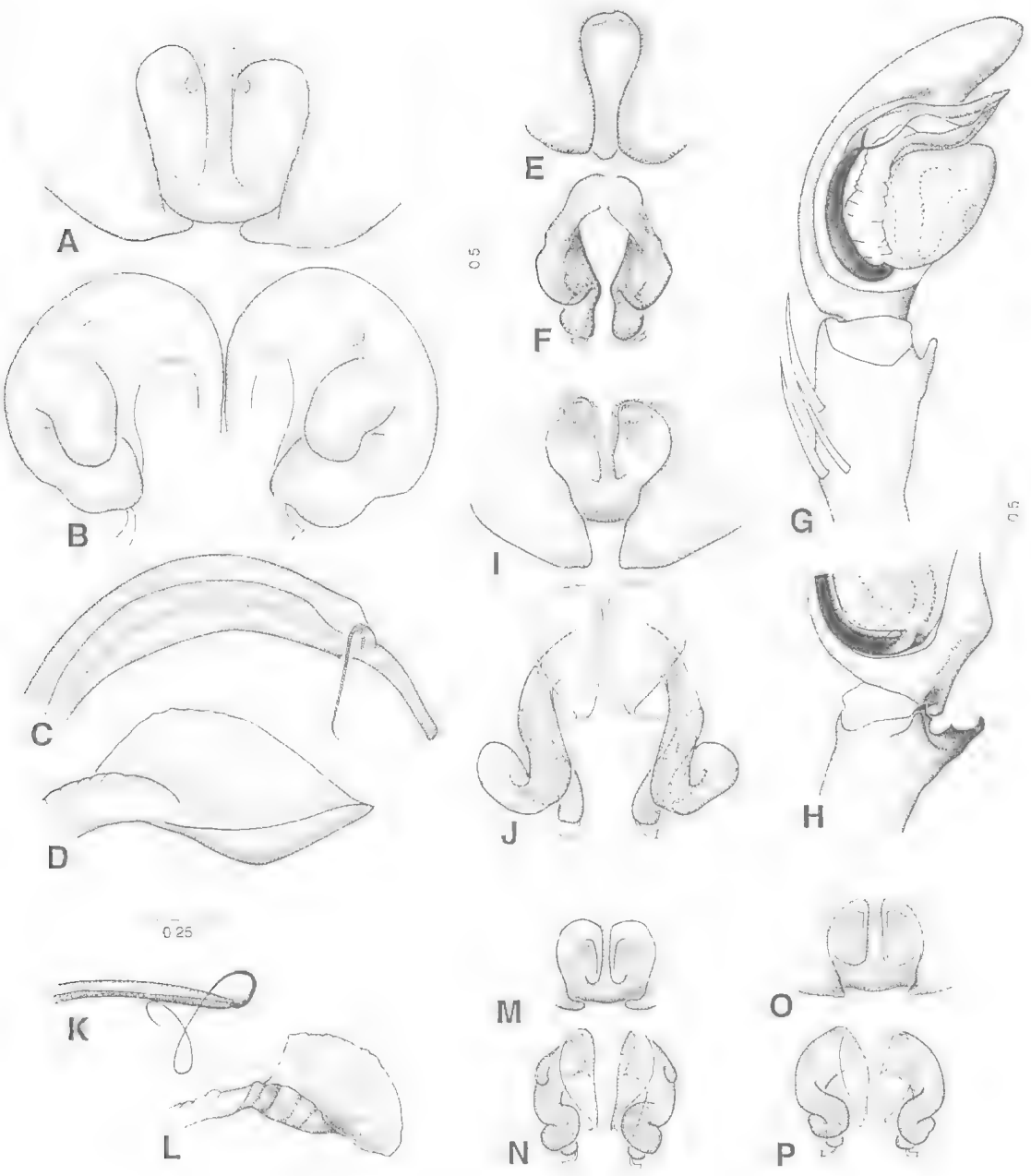

FIG. 17. A-D, *Yiinthi chillagoe*; E-H, *Y. anzsesorum*; I,J, *Y. kakadu*; K,L, *Y. molloyensis*; M,N, *Y. gallonae*; O,P, *Y. torresiana*. A,B,E,F,I,J,M-P, epigyna; C,D,K,L, emboli and conductors; G,H, ♂ palp and tibial apophysis.

pre-flagellar embolus distinguish it from *Y. lycodes*.

Yiinthi chillagoe sp.nov.
(Figs 16A,B,G,H; 17A-D; 20)

TYPE MATERIAL
HOLOTYPE: ♂, Donna Cave, Chillagoe, north Queensland, 17°09'S, 144°31'E, 4.vii.1984, F.D. Stone, F.G. Howarth, QMS14754.
PARATYPES: Chillagoe limestone caves: ♀, Markham Tower, Surprise Packet Cave, 30.vi.1984, F.G. Howarth, QMS14757; ♂, Suicide Tower, Christmas Pot Cave, 29.vi.1984, F.D. Stone, QMS14758; ♀, Royal Arch Cave, 2.vii.1984, F.D. Stone, QMS14755; ♀, Spring Cave, 28.vi.1984, F.G. Howarth, QMS14756; ♂, 18.vii.1978, R. Mascord, AMKS4131; ♀, same data, AMKS4132.

ETYMOLOGY
From Chillagoe, the type locality.

DIAGNOSIS
Large. Pre-flagellar portion of embolus smooth-edged, short flagellum, digitiform post-flagellar region. Tibial apophysis with pointed spur-like projection on anterior edge. Median septum broadening posteriorly to form transverse bar. Very wide insemination ducts with large dorsal lobes.

DESCRIPTION
Male (holotype): CL 11.9, CW 11.5, AL 10.8, AW 6.9. Spination: femora I-III 323, IV 321(2); patellae I,II 001, III, IV 101; tibiae I, II 2026, III, IV 2226. ♂ palp (Figs 16A,B,G,H; 17C,D): hairy cymbium, postero-retrolateral extension with large low rounded lateral projection.
Female: CL 12.7, CW 11.2, AL 11.5, AW 9.2. Spination: femora I-III 323, IV 321; patellae I, II 001, III, IV 101; tibiae I, II 2026, III, IV 2226. Epigynum (Fig. 17A,B).

Yiinthi molloyensis sp.nov.
(Figs 16C,D; 17K,L; 20)

TYPE MATERIAL
HOLOTYPE: ♂, Mt Molloy, northeastern Queensland, 16°41'S, 145°20'E, (exact locality unknown) ix.1969, F. Little, QMS15238.

ETYMOLOGY
From Mt Molloy, the type locality.

DIAGNOSIS
Large. Embolus smooth with long fine flagellum; very short, straight post-flagellar embolic tip. Tibial apophysis with small pointed projection on anterior edge.

DESCRIPTION
Male (holotype): CL 9.4, CW 8.1, AL 9.8, AW 6.0. Spination: femora I-III 323, IV 321; patellae I-IV 101; tibiae I-IV 2326. ♂ palp (Figs 16C,D; 17K,L): postero-retrolateral area of cymbium hollowed without lateral projection. Tegulum almost as wide as long.
The female is unknown.

REMARKS
Y. molloyensis differs from other *Yiinthi* spp. by having 3 dorsal spines on ♂ tibiae.

Yiinthi anzsesorum sp.nov.
(Figs 17E-H; 20)

TYPE MATERIAL
HOLOTYPE: ♂, Hann Tableland, 13km W of Mareeba, north Queensland, 17°00'S, 145°17'E, 2.xii.1988-17.i.1989, R. Storey, G. Dickinson, ex malaise trap, QDPI Ar1425, QMS21196.
PARATYPES: ♀, same data as holotype, QMS21197; ♀, creek camp nr McLeod, Windsor Tableland, 16°14'S, 145°02'E, 26-7.xii. 1980, AE, QMS15197.

ETYMOLOGY
From the acronym, ANZSES for the Australian and New Zealand Schools Exploration Society, the collectors.

DIAGNOSIS
Small. Embolus smooth with long tapering flagellum; post-flagellar portion short, pointed. Membraneous conductor, broadening slightly to sinuous boat-shape, pointed distally. Tibial apophysis tapering to curved tip; pointed process on anterior edge. Median septum barely apparent; lateral lobes converging giving a key-hole appearance to epigynum.

DESCRIPTION
Male (holotype): CL 5.0, CW 4.6, AL 5.0, AW 3.8. Legs 21=43. Spination: leg I missing; femora II, III 323, IV 321; patellae II-IV 101; tibiae II, III 2226, IV, 2126. ♂ palp (Fig. 17G,H): tegulum as wide as long, cymbium without postero-retrolateral extension.
Female: CL 5.0, CW 4.4, AL 7.2, AW 5.3. Spination: femora I-III 323, IV 321; patellae I, II,

IV 000, III 001; tibiae I 1026, II-IV 2026. Epigynum (Fig. 17E,F).

THE *KAKADU* GROUP

Small spiders. Legs 21=43 or 2413. Venter without pattern or pale with some mottling. Without projection on anterior edge of ♂ tibial apophysis. Epigynum with chitinous intuckings at gonopores.

Yiinthi kakadu sp.nov., *Y. gallonae* sp.nov., *Y. torresiana* sp.nov.

Yiinthi kakadu sp.nov.
(Figs 16E,F; 17I,J; 20)

TYPE MATERIAL

HOLOTYPE: ♂, Radon Ck, Mt Brockman, Kakadu National Park, Northern Territory, 12°45'S, 132°53'E, 14.xi.1979, RJR, QMS15195.

PARATYPES: Northern Territory: ♀, same data as holotype, QM S15196; ♀, Radon Ck, open forest, 14.xi.1979, QMS14834; 3 ♂, 2 ♀, South Alligator Inn, 12°40'S, 132°30'E, 7-9.xi.1979, RJR, QMS14836; 4 ♂, 2 ♀, West Alligator R. mouth, 12°11'S, 132°16'E, 10-12.xi.1979, RJR, QMS14837. ♀, same data, QMS14835. Western Australia: ♀, Walcott Inlet, 16°23'S, 124°29'E, 18.vi.1988, B.Y. Main, BYM 88/K1051; 2 ♀, Misery Spring, Old Lissadell Hmstd, 16°41'S, 128°33'E, 23.x.1971, RJM, WAM88/1967-8.

ETYMOLOGY

From the Kadadu National Park, the locality of the holotype and many of the paratypes.

DIAGNOSIS

Small. Venter without pattern. Thick smooth, tapering embolus with long tapering spiral flagellum, post flagellar embolus very short. Pale chitinous intuckings form dorsal flanges round openings to insemination ducts.

DESCRIPTION

Male (holotype): CL 5.8, CW 5.2, AL 6.9, AW 4.7. Legs 21=43. Spination: femora I-III 323, IV 321; patellae I-IV, 101; tibiae I, II 2226, III, IV 2126. ♂ palp (Fig. 16E,F): postero-retrolateral cymbium, hollowed without lateral projection. Posterior portion of tibial apophysis pointed.

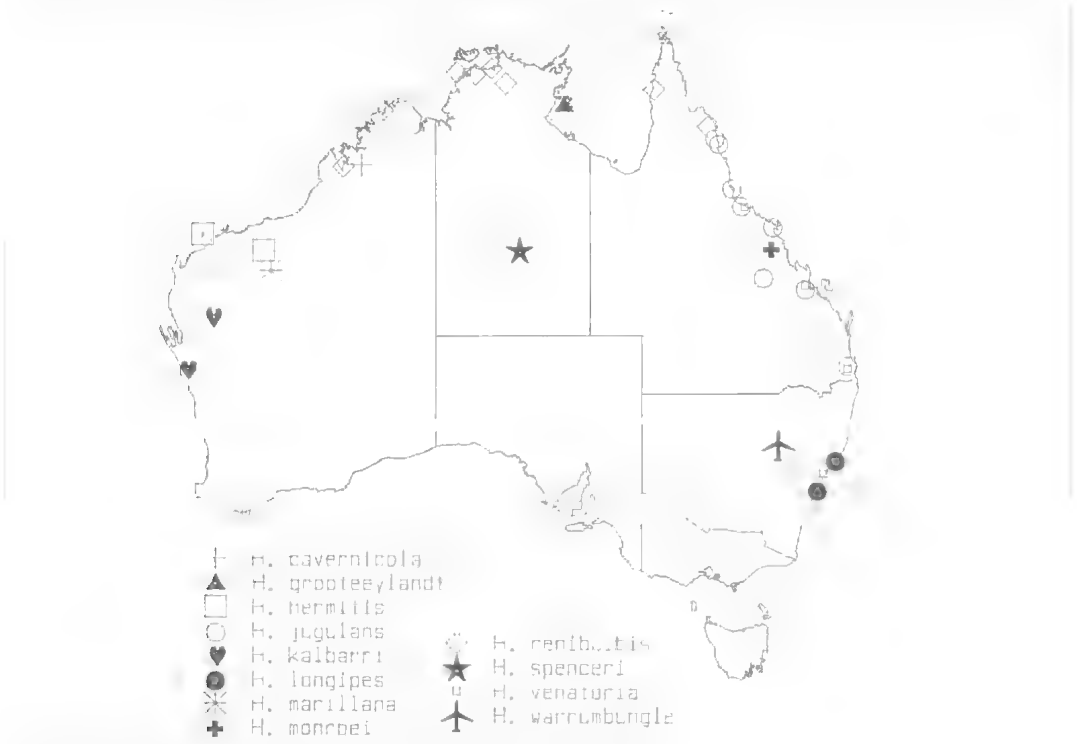

Fig. 18. Distribution of *Heteropoda* spp. in Australia.

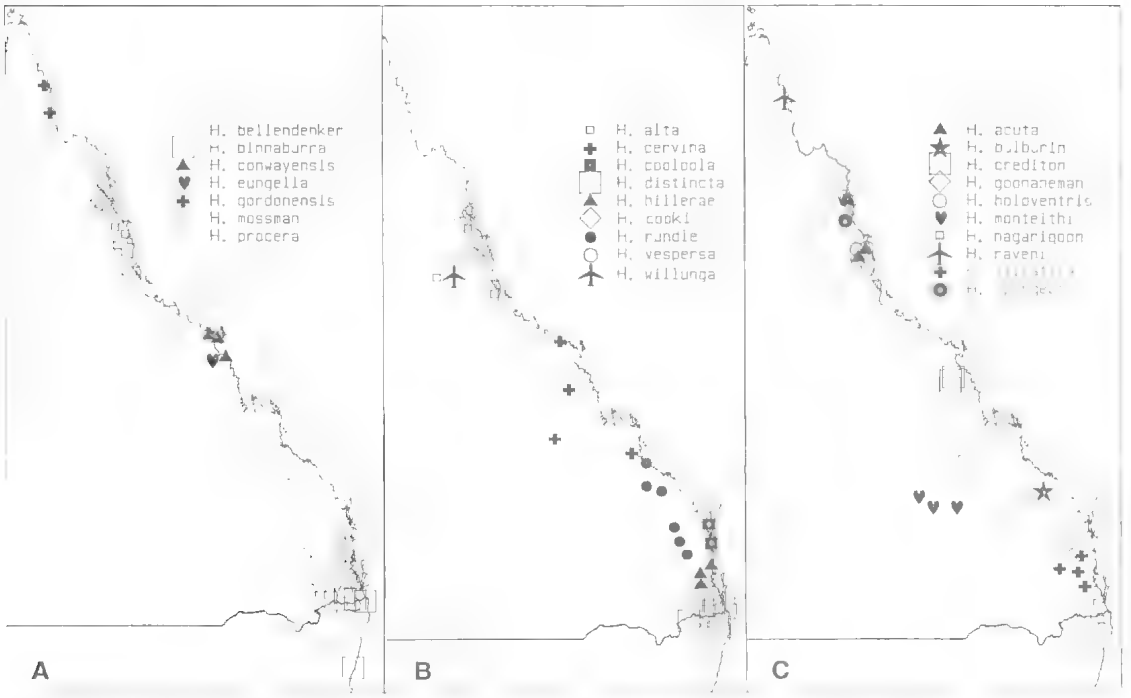

Fig. 19. A-C, distribution of *Heteropoda* spp. in Queensland and northern New South Wales.

Fig. 20. Distribution of *Yiinthi* spp. in northern Australia.

Female: CL 5.8, Cw 5.2, AL 6.7, AW 4.2. Spination: femora I-III 323, IV 321; patellae I, III, IV 001, III 101; tibial I-IV 2026. Epigynum (Fig. 17I,J): lateral lobes converging; ♀ median septum with short transverse bar.

Yiinthi gallonae sp. nov.
(Figs 16I,J; 17M,N; 20)

TYPE MATERIAL
HOLOTYPE: ♂, Bamaga, northern Queensland, 10°53'S, 142°24'E, 8.xii.1986, JG, QMS21200.
PARATYPES: ♀, Lockerbie Scrub, Cape York, 9.xii.1986, JG, S13019; ♂ (freshly moulted), Lockerbie Scrub, 28.viii.1985, M. Bennie, QMS15007. Torres Strait: 2 ♂, Horn I, 10°37'S, 142°17'E, 2-8.xii.1986, JG, QMS12363; 2 ♂, ♀, Yorke Is, 9°44'S, 145°25'E, 27-28.xi.1986, JG, QMS21201; 5 ♀, same data, QMS12436; ♀, Yorke Is. 13.vii.1974, H. Heatwole, E. Cameron, QMS15148; ♂, 2 ♀, Yam I., 9°53'S, 142°45'E, 28.xi-2.xii.1986, JG, QMS12421.

ETYMOLOGY
In honour of the late Julie-Ann Gallon, collector of the holotype.

DIAGNOSIS
Small. Venter pale with mottling, embolus very broad; with short straight flagellum; *pars pendula* well developed with anterior sclerotized ridge. Conductor, broadly stalked, deep jug-shape distally. Pale chitinous intuckings round openings to ♀ insemination ducts; median septum anchor-shaped.

DESCRIPTION
Male (holotype): Cl 5.6, CW 5.2, AL 5.8, AW 3.8. Legs: 2413. Spination: femora I, II 323, III 313, IV 321; patellae I-III 101, IV 001; tibiae I, II 2226, III 22(1)26, IV 2126. ♂ palp (Fig. 16I,J): postero-retrolateral cymbium hollowed ventrally. Tibial apophysis stout, digitiform, inwardly curved tip.

Female: CL 4.6, CW 4.2, AL 5.1, AW 3.3. Pale venter with red-brown mottling. Legs 2413. Spination: femora I-III 323, IV 321; patellae I-III 000, IV 001; tibiae I 1026, II, III 2026, IV 2126. Epigynum (Fig. 17M,N): median septum anchor-shaped; insemination ducts with small lateral lobes.

Yiinthi torresiana sp.nov.
(Figs 17O,P; 20)

TYPE MATERIAL
HOLOTYPE: ♀, Moa I., Torres Strait, 10°11'S, 142°16'E, along fresh water creek, savannah woodland, 23.ii.1975, E. Cameron, QMS15199.
PARATYPES: 2 ♀, same data as holotype, QMS15147; ♀ Murray Is, 9°56'S, 144°04'E, vii-viii.1974, H. Heatwole, E. Cameron, QMS15149.

ETYMOLOGY
From Torres Strait, general locality of the islands.

DIAGNOSIS
Small. ♀ median septum anchor-shaped; chitinous intuckings at gonopores; insemination ducts without lateral lobes.

DESCRIPTION
Female (holotype): CL 5.4, CW 4.9, AL 7.1, AW 4.8. Venter mottled with pale trapezoid area. Legs 2413. Spination: femora I-III 323, IV 321; patella I 000, II-IV 001; tibiae I 1026, II-IV 2026. Epigynum (Fig. 17O,P).
The male is unknown.

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This project owes much to many people. It was begun in collaboration with Dr R.J. Raven in 1977 and I am indebted to him for early descriptions, measurements, drawings and scanning electron micrographs. Sybil Monteith and Clare Bremner contributed illustrations and Chris Lambkin helped with the lay-out of figures. David Nebauer assembled the maps from the locality data. Recent scanning micrographs were taken by Don Gowanlock of the Electron Microscope Centre of the University of Queensland. Dr J. Coddington demonstrated how best to see the tapetum of freshly killed *Heteropoda jugulans* and *Holconia immanis*. The Rev. D.A. Thompson of Nungalinya College, Darwin gave me the information on the Aboriginal word, 'yiinthi'. The Board of Trustees and the Directorate of the Queensland Museum have been very supportive, especially in the final phase of the work. My thanks to many members of staff, particularly Peta Woodgate who saw the manuscript through all but its final stages and Jennifer Mahoney who saw it to completion.

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INDEX TO SPECIES

CARIDINA PEDICULTRATA, A NEW FRESHWATER ATYID SHRIMP (CARIDEA:ATYIDAE) FROM HUNAN PROVINCE, CHINA

ZHAOLIANG GUO AND SATISH C. CHOY

Guo, Z. & Choy, S.C. 1994 06 01: *Caridina pedicultrata*, a new freshwater atyid shrimp (Caridea:Atyidae) from Hunan Province, China. *Memoirs of the Queensland Museum* 35(1): 123-127. Brisbane. ISSN 0079-8835.

A new freshwater atyid shrimp, *Caridina pedicultrata* from high elevation (800m) in Hunan Province, China is described. It has a long, non-tapered endopod on the first male pleopod, well developed and trapezoidal appendix masculina which is almost as long as the endopod and bearing relatively short hamate setae, distinctive pereiopod shape, spination and segmental ratios, shape and spination of the posterior telsonic margin and large eggs. Ten species of *Caridina* and one of *Neocaridina* are now known from Hunan Province. ☐ *Crustacea, Atyidae, Caridina pedicultrata, new species, Hunan Province, China.*

Zhaoliang Guo, Department of Animal Sciences and Fishery, Hunan Agricultural College, Changsha 410128, China; Satish C. Choy, Crustacea Section, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4001, Australia; 31 January 1994.

The ten known species of atyid shrimps from Hunan Province, China are *Caridina ablepsia* Guo, Jiang & Zhang,1992, *C. baojingensis* Guo, He & Bai,1992, *C. glossopoda* Liang, Guo & Gao,1993, *C. hofendopoda* Shen,1948, *C. hunanensis* Liang 1993, *C. lanceifrons*, Yu,1938, *C. lima* Liang, Guo & Gao,1993, *C. longispina* Guo, He, Xu & Gui,1992, *C. spinosa* Liang,1964 and *Neocaridina denticulata* de Haan,1844.

On 15th August 1992, numerous specimens of a new atyid shrimp were collected from a small freshwater stream near Huaihua City, Hunan (c. 27°40'N, 110°11'E) by Zhaoliang Guo. The collection site is in a col (altitude c.800m) of Xuefeng Mountain, with rice fields nearby. The stream has a rocky bed, is 1-2m wide and 0.2-1.1m deep. The primary type specimens are in the collection of the Hunan Agricultural College (HAC). Some male and female paratypes are deposited in the Queensland Museum(QMW).

SYSTEMATICS

Family ATYIDAE
Caridina H. Milne Edwards,1837
Caridina pedicultrata sp.nov.
(Figs 1,2)

MATERIAL EXAMINED

HOLOTYPE: 1 adult male, total length (TL) 15.7mm, post- orbital carapace length (CL) 4.6mm, pre-orbital rostral length (RL) 0.79mm.

ALLOTYPE: 1 ovigerous female, TL 18.7mm, CL 5.8mm, RL 1.0mm.

PARATYPES: HAC, 5 ♀, 5 ♂; QMW19898, 2 ♀, 2 ♂

DESCRIPTION

Body. Small, slender, subcylindrical; males up to 17.7mm TL, females up to 21.4mm TL.

Rostrum (Fig.1A,B). Short and rather high, 0.13-0.21 of CL; reaching or extending beyond tip of eyes; either convex or straight, tip often slightly curved downwards; setose and typically unarmed or sometimes with 1-3 dorsal teeth and 1 ventral tooth placed distally; lateral carina dividing rostrum into two unequal parts, continuing posteriorly to orbital margin.

Eyes (Fig.1A,B). Small, on short ocular peduncle; cornea globular, well developed.

Carapace (Fig. 1A). Rough, surface covered with microspinules; branchiostegal groove conspicuous. Pterygostomian angle broadly rounded, slightly produced anteriorly. Antennal spine below lower orbital angle, short but strong.

Antennule (Fig.1A,B). Stylocerite 0.79 length of basal segment; second segment about 0.45 length of basal antennular segment and about 1.1 times as long as third segment; all segments with plumose setae (setal terminology after Felgenhauer,1992). Flagella long, simple.

Antenna (Fig.1A). Scaphocerite reaching tip of antennular peduncle; outer margin straight, asetose, ending in strong subapical spine; proximal lamella and interior margin with plumose setae.

Mandibles, maxillula, maxilla, first and *second maxillipeds* and *branchial formula*. Typical for genus, as described for other species (Choy & Ng,1991; Choy,1992).

Third maxilliped (Fig.1C). Reaching beyond tip of scaphocerite; basal segment of endopod

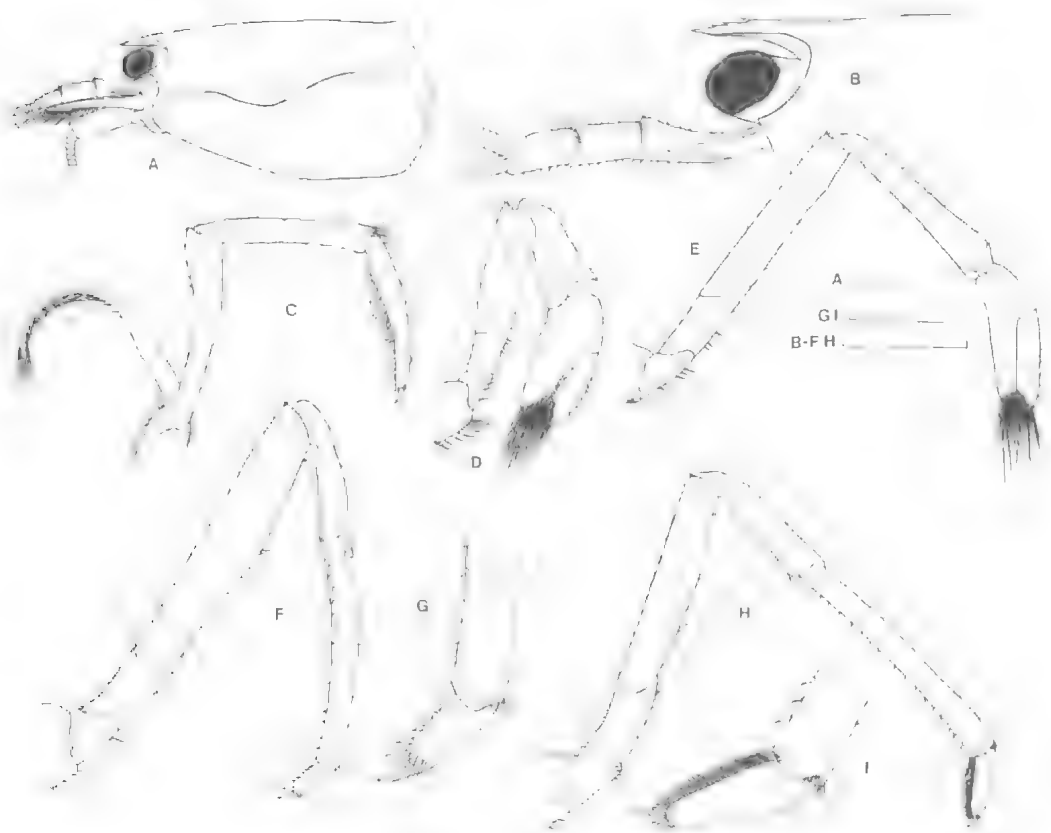

FIG. 1. *Caridina pedicultrata* sp. nov. A, holotype male; B, paratype male. A, cephalothorax; B, rostral and antennular region; C, third maxilliped; D, first pereiopod; E, second pereiopod; F, third pereiopod; G, dactylus of third pereiopod; H, fifth pereiopod; I, dactylus of fifth pereiopod. Scales: A-F,H = 1.0mm; G,I = 0.4mm.

about 5.2 times as long as broad, with few hamate setae on distal outer margin. Penultimate segment about 6.6 times as long as broad and about 0.87 length of basal segment. Distal segment about 0.87 length of penultimate segment, ending in large claw- like apical hamate seta surrounded by simple and pappose setae, behind which there are about 8-11 smaller hamate setae on distal third of posterior margin; proximally a clump of serrate and pappose setae. Exopod reaching about 0.5 of penultimate endopod segment, distal margin with plumose setae.

First pereiopod (Fig.1D). Reaching about tip of eye. Chela 2.0–2.5 times as long as wide, about 1.0–1.3 times length of carpus; movable finger about 3.1–4.4 times as long as wide, 1.0–1.6 times length of palm; setal brushes well developed. Carpus attached to chela ventrally, excavated disto- dorsally, 1.7–2.1 times as long as wide, shorter than chela, about 0.83–1.02 length of merus. Ischium about 0.38–0.51 length of merus.

Second pereiopod (Fig.1E). Reaching beyond tip of scaphocerite, more slender and longer than first pereiopod. Chela 2.7–3.6 times as long as broad, about 0.67–0.96 length of carpus, movable finger about 4.0–4.8 times as long as wide and 1.5–1.7 times length of palm; setal brushes well developed. Carpus slightly excavated distally, 4.5–6.0 times as long as broad, much longer than chela, about same length as merus. Ischium about 0.30–0.43 length of merus.

Third pereiopod (Fig.1F,G). Reaching base of dactylus, about 0.25 of propodus reaching distal scaphocerite. Dactylus 2.2–2.9 times as long as wide, ending in prominent claw-like hamate seta,

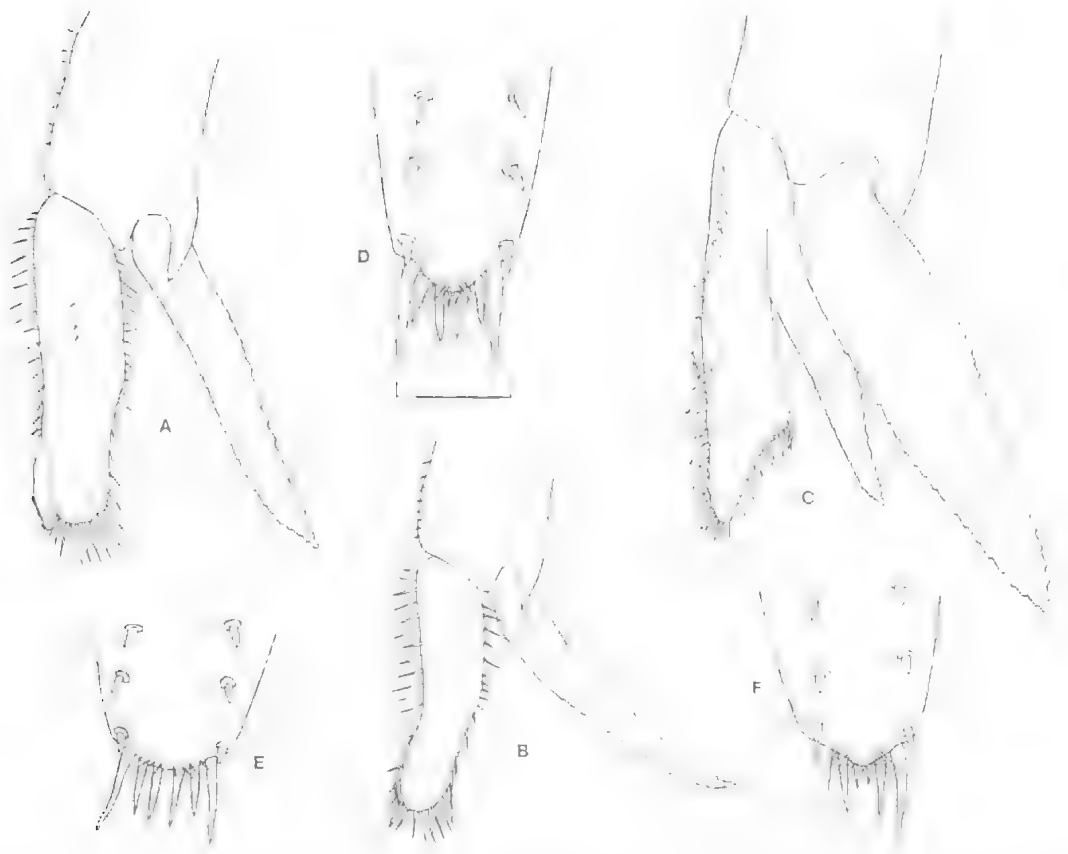

FIG. 2. *Caridina pedicultrata* sp. nov. A, B, first pleopod of male; C, second pleopod of male; D-F, dorso-posterior region of telson. Scales: A-C = 0.5mm; D-F = 0.4mm.

behind which posterior margin bears 4-6 shorter hamate setae, reducing in size proximally. Propodus 8.2–9.7 times as long as wide, 4.8–5.2 times length of dactylus, posterior margin bearing numerous small hamate setae. Carpus about 0.67-0.85 length of propodus, well developed distal projection, posterior and lateral surface with hamate setae. Merus about 1.5–1.9 times as long as carpus, slightly bowed, with few hamate setae along posterior margin. Ischium about 0.33 length of propodus, twice that of basis.

Fourth pereiopod. Similar to third.

Fifth pereiopod (Fig.1H,I). Reaching middle of second segment of antennular peduncle. Dactylus 2.9–3.8 times as long as wide, ending in claw-like apical hamate seta, bearing comb-like row of 42–54 hamate setae on posterior margin. Propodus 7.9–10.7 times as long as wide, 3.8–5.8 times length of dactylus, bearing numerous short hamate setae on posterior margin. Carpus about 0.42–0.57 length of propodus, bearing distal projection and distal hamate seta. Merus distinctly shorter but wider than propodus, with 2–3 large hamate setae. Ischium about twice length of basis, with simple and pappose setae.

First pleopod (Fig.2A,B). Endopod in male compressed, ovate, a little wider proximally, very long, about 0.82 length of exopod, about 3.7 times as long as wide, extreme portion slightly bent, inner border usually concave at distal 0.4, but almost straight in some specimens, outer border noticeably convex at middle, slightly concave at distal 0.3, both with marginal spine-like simple seta. Appendix interna well developed, arising from sub-distal endopod, reaching beyond its tip.

Second pleopod (Fig.2C). Endopod in males about 0.71 length of exopod. Appendix masculina arising from base of endopod, trapezoidal,

TABLE 1. Length (L) and width (W), in mm, of pereiopod segments of primary type specimens of *Caridina pedicultrata* sp. nov. P1-P5, pereiopods 1-5.

	Dactylus		Propodus		Carpus		Merus		Ischium	
	L	W	L	W	L	W	L	W	L	W
HOLOTYPE MALE										
P1	0.60	0.18	1.00	0.49	0.93	0.44	0.91	0.29	0.29	0.21
P2	0.78	0.21	1.16	0.42	1.79	0.32	1.57	0.29	0.59	0.29
P3	0.35	0.14	1.73	0.19	1.36	0.33	2.23	0.47	0.53	0.32
P5	0.53	0.16	1.99	0.22	1.11	0.27	1.60	0.31	0.49	0.27
ALLOTYPE FEMALE #1										
P1	0.64	0.19	1.21	0.49	0.97	0.51	1.07	0.35	0.49	0.29
P2	0.84	0.18	1.49	0.43	2.28	0.40	1.96	0.33	0.91	0.30
P3	0.41	0.14	2.13	0.26	1.36	0.36	2.64	0.44	0.71	0.34
P5	0.51	0.15	2.21	0.22	1.29	0.29	1.88	0.29	0.57	0.29

very long, about same length as endopod, bearing many stout hamate setae on inner and distal parts. Appendix interna arising from about mid-appendix masculina, very short and coarse, with many retinaculae distally.

Abdomen. Well developed, rotund, glabrous; sixth abdominal segment 0.32–0.39 CL.

Telson (Fig.2D,F). 0.39–0.46 CL, distinctly longer than sixth abdominal segment, tapering posteriorly, ending in rounded margin with sharp, thin median hamate seta in some specimens, dorsal surface with 5–6 pairs of stout hamate setae including pair at posterolateral angles. Posterior margin with 2–3 pairs of intermediate plumose setae, middle one usually thinnest and shortest, all distinctly shorter than lateral pair. Uropods distinctly longer than telson, diaeresis on exopod bearing 19–22 hamate setae.

Egg size. Eggs with well developed embryos measuring 0.69–1.12 by 1.18–1.40mm.

Live colouration. All specimens light greenish blue.

ETYMOLOGY

From the trapezoidal, foot-like shape (pedicule = 'foot-stalk') of the appendix masculina of second male pleopod. It is used as a noun in apposition.

REMARKS

This species closely resembles *Caridina bamaensis* Liang & Yan,1983 (from Guangxi) and *C. brevispina* Liang & Yan,1986 (from Guizhou) but differs from those 2 species in the lateral carina and some teeth on a much straighter rostrum, more slender first pereiopod, broader dactylus and longer propodus of the third pereiopod and the more trapezoidal shaped, long appendix masculina of the second male pleopod (Table 2).

The unique character of this species is the very long and trapezoidal shaped appendix masculina on the second male pleopod. No other atyid shrimp is known to have this. Its shape could be intermediate to the lanceolate one of known *Caridina* and the ovate one of *Neocaridina*. The shape of the endopod of the first male pleopod is also different from other *Caridina* and *Neocaridina*, but resembling the former. However, at this stage, we do not feel that the separation of this species into a new genus is warranted.

The large size of the eggs of *C. pedicultrata*

TABLE 2. Comparison of some morphometric characters of *Caridina pedicultrata* sp. nov., *C. bamaensis* and *C. brevispina*. am/ai, ratio of appendix masculina and appendix interna lengths on second male pleopod; C1, carpus of first pereiopod; C2, carpus of second pereiopod; D3, dactylus of third pereiopod; P3, propodus of third pereiopod; L, length; W, width.

	C. pedicultrata	*C. bamaensis*	*C. brevispina*
C1L/C1W	1.7–2.1	1.4–1.6	1.3–1.5
C2L/C2W	4.5–6.0	4.9–6.1	3.9–4.5
D3L/D3W	2.2–2.9	2.9–3.2	3.2–3.8
P3L/D3L	4.8–5.2	3.4z–3.9	3.2–3.8
Spinules on diaresis	19–22	18–22	14–17
am/ai	>3	<2	c. 2

suggests highly abbreviated or direct development.

ACKNOWLEDGEMENTS

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SOLENOZETES GALLONAE SP. NOV., FIRST RECORD OF THE PLASMOBATIDAE IN AUSTRALIA (ACARI: ORIBATIDA)

GLENN S. HUNT

Hunt, G.S. 1994 06 01: *Solenozetes gallonae* sp. nov., first record of the family Plasmobatidae in Australia (Acari: Oribatida). *Memoirs of the Queensland Museum* 35(1): 129-134. Brisbane. ISSN 0079-8835.

Solenozetes gallonae sp. nov. is described from rainforest in Queensland, Australia, and a rediagnosis given for *Solenozetes* Grandjean, 1932 (Plasmobatidae). The status and distribution of other species in the genus are summarised and generic level characters analysed.
☐ *Acari, Oribatida, Plasmobatidae, Solenozetes, Australia, rainforest.*

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The Plasmobatidae Grandjean, 1961 is a small group of oribatid mites with a mostly tropical-subtropical distribution extending from the Oriental Region and western Pacific to the eastern Palaearctic and Neotropical Regions. They inhabit litter, moss and epiphytes on tree trunks.

Together with the Hermanniellidae, they constitute the superfamily Hermannielloidea, a taxon characterised by distinctive lateral tubes which bear the pore of the lateral opisthosomal glands (gla in Fig. 1D). Adult Plasmobatidae carry the exuviae ("scalps") of the larva and of three nymphal instars (Fig.1A,B) which obscure the inconspicuous notogastral setae. They are readily distinguished from the Hermanniellidae which carry a tightly appressed and inconspicuous tritonymphal scalp which bears conspicuous setae. The gnathosoma of the Plasmobatidae is characterised by an elongate subcapitulum above which lie the elongate chelicerae. Definitions of both families are given by Grandjean (1962).

The Plasmobatidae comprises three genera, *Plasmobates* Grandjean,1929, *Solenozetes* Grandjean,1932 and *Orbiculobates* Grandjean, 1961, which may be distinguished by the key in Balogh & Balogh (1988,1992). Generic level characters are analysed below with insights provided by *Solenozetes gallonae* sp. nov. The occurrence of this species in Australia is an important addition to the known distribution of the family.

MATERIALS AND METHODS

In general, terminology follows Balogh & Balogh (1992), and Grandjean (1961) and Norton (1977) for leg chaetotaxy. The shapes of setae and surface ornamentation follow Mahunka & Zombori (1985). Measurements are in micrometres, those for body length were made ventrally from the tip of the rostrum to the rear of the scalps. A Cambridge Stereoscan 120 was used for SEM. Repositories for type material are AM, Australian Museum, Sydney; ANIC, Australian National Insect Collection, Canberra; QM, Queensland Museum, South Brisbane.

CHARACTER ANALYSIS AT GENERIC LEVEL

Scalps. Grandjean (1932) erected *Solenozetes* as he considered the type species, *Plasmobates cribratus* Grandjean, 1929 from Venezuela, possessed only a tritonymphal scalp. In his 1961 paper, however, he regarded this as an error (scalps can fall off) and questioned the separate status of *Solenozetes*. He nevertheless retained the genus, without giving a clear rediagnosis. Apart from an anterior indentation which characterises the *Orbiculobates* tritonymphal scalp (Grandjean, 1961), scalp morphology appears to be useful only at the species level.

Shape of lateral tubes. Balogh (1972) used this as a key character to distinguish *Plasmobates* from *Solenozetes* and was followed, rather tentatively, by Mahunka (1983) when describing *S. flagellifer* from Mexico. This key character was abandoned by Balogh & Balogh (1988; 1992) and appears to be of value only at the species level.

Number of genital setae and presence/absence of aggenital setae. Balogh & Balogh (1988) transferred *P. carinatus* Hammer, 1961 from Peru and *P. flagellatus* Balogh & Mahunka, 1969 from Amazonia to *Solenozetes* on the basis that they had 6 pairs of genital setae and no aggenital setae (*Plasmobates* has 7 pairs and 1 pair respectively).

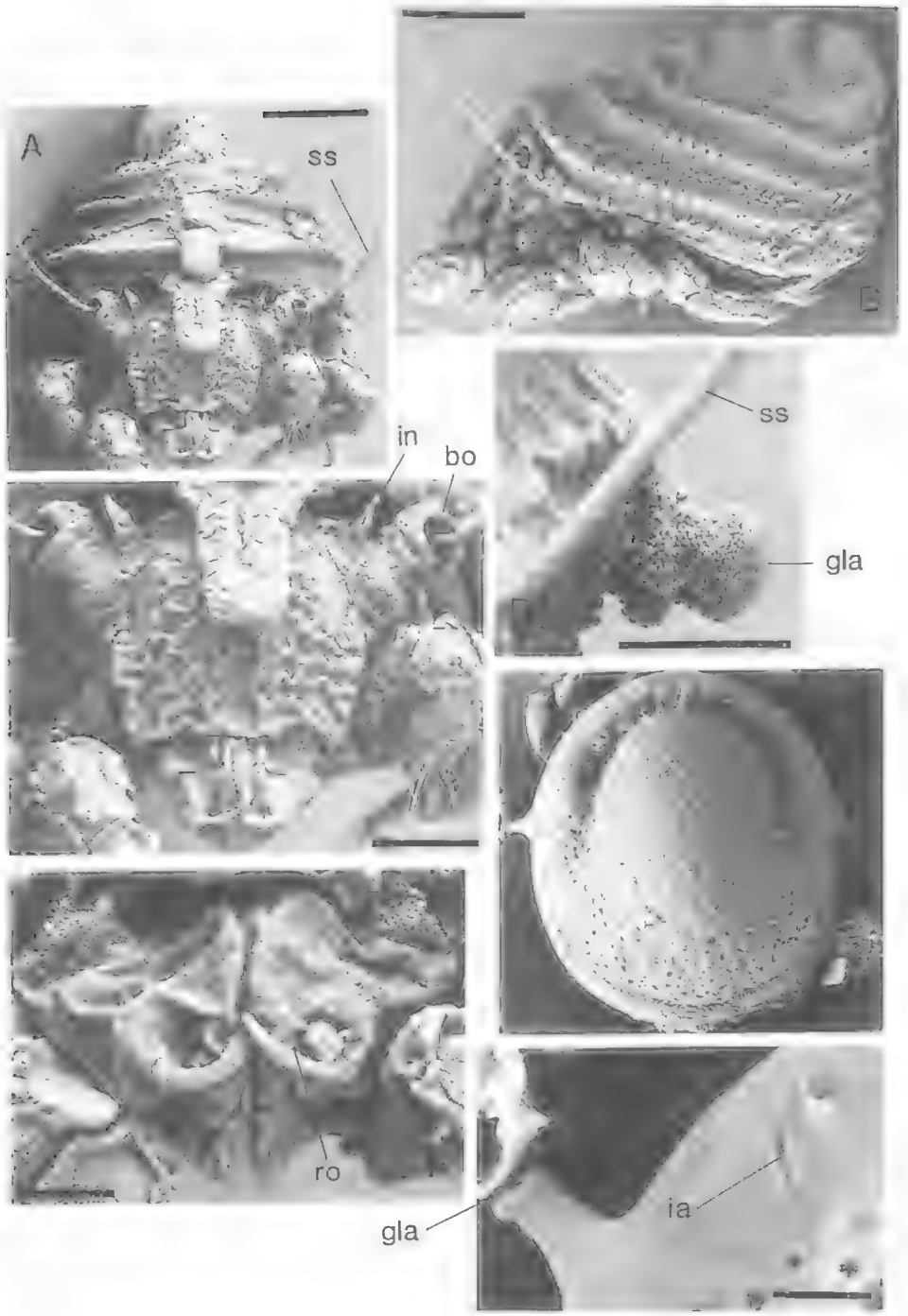

FIG. 1. *Solenozetes gallonae* sp. nov. A,C,D,F, frontal. A, whole body; C, prodorsum; D, lateral tube with cerotegument; F, rostral area. B, whole body, lateral; E, notogaster without scalps, dorsal; G, detail lateral tube area without cerotegument and scalps (bo, bothridium; gla, lateral tube of notogastral gland; ia, fissura ia; in, interlamellar seta; ro, rostral seta; ss, sensillus). Scale bars: A,B,E, 100µm; C, 50µm; D,F,G, 20µm.

P. hyalinus Hammer, 1971 from Fiji, *P. acutirostrum* Hammer, 1973 from Western Samoa and *P. asiaticus* Aoki, 1973 from Japan have 6 pairs of genital and no aggenital setae. Hammer (1979) describes *P. javensis* from Java as having 7 pairs of long genital setae but no aggenital setae. I have examined the type and it appears to have 6 genital setae on the right side and a doubtful alveolus of a seventh on the left. However, formal placement of some or all of these species in *Solenozetes* should await a thorough revision of the family including reappraisal of characters and a re-examination of the type of *S. cribratus*.

P. schubarti Perez-Iñigo & Baggio, 1988 from Brazil has 7 pairs of genital setae and 1 pair of aggenital setae and would presumably remain in *Plasmobates* together with the type species, *P. pagoda* Grandjean, 1929 from Martinique.

Shape of bothridium. Except perhaps for *O. transvectus* (Grandjean, 1929), descriptions of species with 6 pairs of genital setae (and *P. javensis*), seem to indicate that the bothridial wall forms a partial hood over the bothridial cavity but is deeply invaginate anterolaterally (Fig. 1C). In *P. pagoda* and *P. asiaticus* (7 pairs), the bothridium is not hooded and has a much more open structure. It is invaginate in the mesad as well as the laterad wall. A "hooded" bothridium may be a shared derived character for *Solenozetes* and *Orbiculobates*, as suggested by its absence in Hermanniellidae and Liodidae, outgroups which have a low, open bothridium. The more open bothridium seems to be correlated with a shorter sensillus.

Notogastral sculpturing. Most *Plasmobates* and *Solenozetes* have a pitted (alveolate) notogaster. The two *Orbiculobates* species, *O. orbiculus* (Grandjean, 1929) and *O. transvectus*, both from Martinique, have a smooth notogaster with scalp retention assisted by an anterior tuft of filaments. *Orbiculobates australis* Balogh & Csiszar, 1963 from Argentina, however, has a smooth notogaster without filaments. It has subsequently been placed in *Solenozetes* by Balogh & Balogh (1988).

Accessory tooth on movable finger of chelicera (as in Fig.2C). Grandjean (1929: pl.3F; 1961) does not record it but R.A. Norton (pers. comm.) reports it in a new species of *Orbiculobates* and several probably undescribed *Solenozetes spp.and Plasmobates* spp. It is present in *S. gallonae* and on the types of *S. carinatus* and *P. javensis*. The structure appears to be a shared derived character at the family level. Its function is unknown but it may assist in breaking food.

SYSTEMATICS

Solenozetes Grandjean,1932

Solenozetes Grandjean,1932: 653; 1961: 127; Balogh, 1972: 57; Balogh & Balogh, 1988: 87; 1992: 42.

TYPE SPECIES

Plasmobates cribratus Grandjean,1929; by monotypy.

DIAGNOSIS

Plasmobatidae with 6 pairs of genital setae but no aggenital setae. Anterior margin of notogaster without mesial tuft of filaments and correlated invagination of tritonymphal scalp. Notogaster usually alveolate or foveolate; lateral tubes of variable shape. Sensillus very long, filiform or sometimes flagellate; posterior wall of bothridium forms partial hood over bothridial cavity, anteriolateral wall deeply excavate allowing sensillus greater movement in laterad direction. Chelicera of at least some species with strong accessory tooth on movable finger.

Solenozetes gallonae sp. nov.
(Figs 1-3)

ETYMOLOGY

For Ms Julie Gallon who collected the material.

TYPE MATERIAL

HOLOTYPE: adult, QM, Queensland, foot of Blackbutt Range, 5km. E. of Benarkin, rainforest, leaf litter, QM berlesate 522, J. Gallon, 30 Mar 1983.

PARATYPES: QM, same data, 2 adults; AM, same data, 1 adult; ANIC, same data, 1 adult.

OTHER MATERIAL

QMS20116 (SEM Stub No. 142), foot of Blackbutt Range, 5km. E. of Benarkin, rainforest, leaf litter, QM berlesate 522, J. Gallon, 30 Mar 1983, 2 adults; QMS20117 (SEM Stub No. 100), same data, 5 adults; QM (SEM Stub No. 129), same data, adult notogaster without scalps.

DIAGNOSIS

Sensillus much longer than distance between interlamellar setae, filiform, not flagellate, and not expanding subdistally; lateral tubes directed only slightly forward and distally expanded into

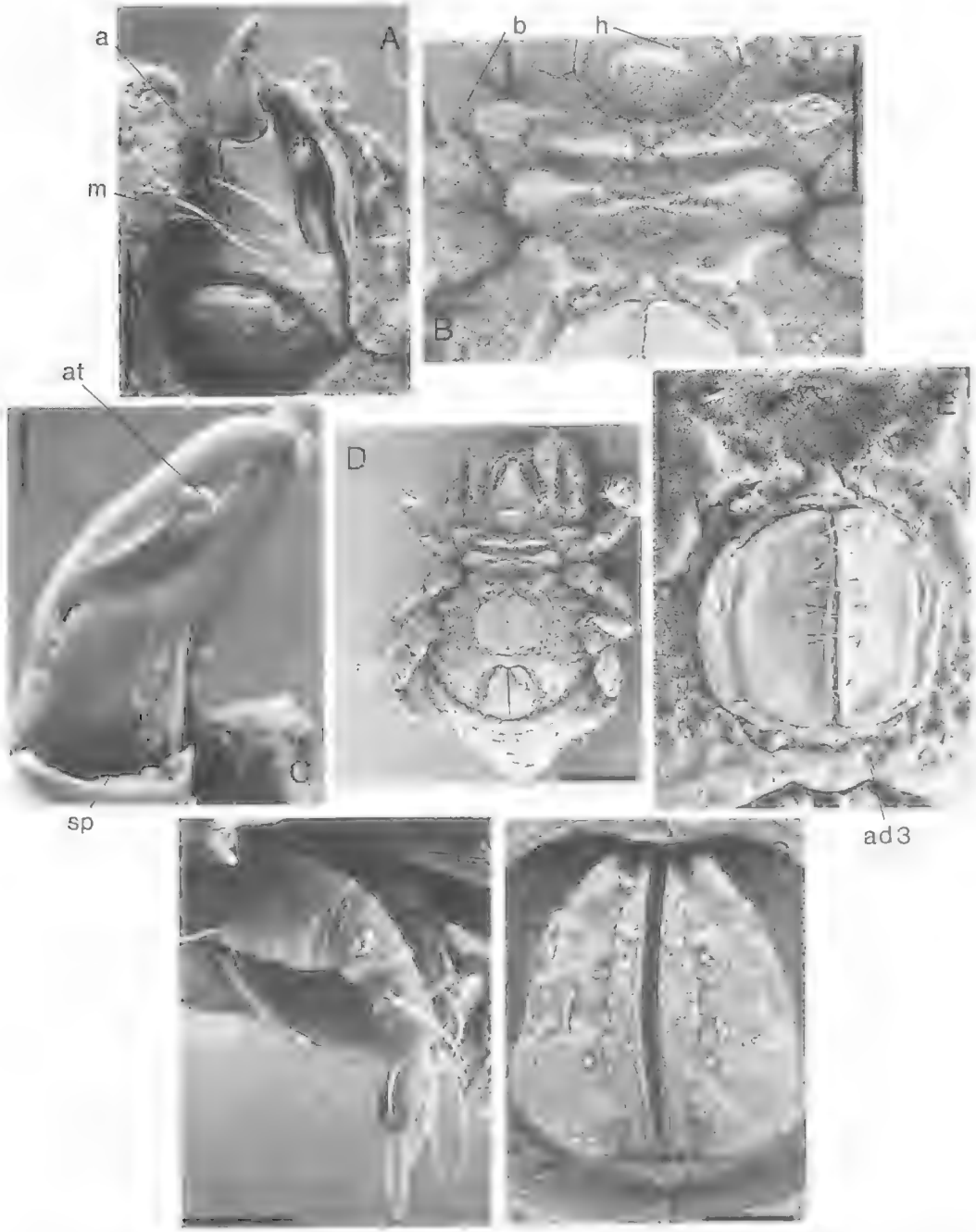

FIG. 2. *Solenozetes gallonae* sp. nov. A-G, ventral aspect. A, gnathosoma; B, epimeral region; C, right chelicera; D, whole animal; E, genital plates; F, pedipalp; G, anal plates. a,m,h, gnathosomal setae; ad3, adanal seta; at, accessory tooth; b, lateral boss between legs I and II; sp, sword-like process. Scale bars: A,B,E, 50µm; D, 100µm; C, 10µm; F,G, 20µm.

a knob-like structure; rostral setae robust, short and curved strongly inwards.

Description

Adults. Grey; body small, 7 specimens 355, 376, 402, 406, 420, 422, 423µm long.

Prodorsum. Rostrum separated from remainder of prodorsum by depressed area and distinct break in cerotegument pattern (Fig. 1C) but not by deep narrow groove. Rostral tecta converging to V-shaped point, separated by mesal split; rostral setae robust, short, arising from apophysis and curved strongly inwards (Fig. 1F). Lamellar setae on margin of prodorsum, extremely minute. Posterior to rostrum cerotegument strongly folded into irregular reticulate pattern. Bothridium long; posterior wall forming partial hood over cavity (Fig. 1C), anterolateral wall deeply excavate; sensillus long (Fig. 1A,B), about 40% longer than interbothridial distance, filiform but not flagellate, more or less even in diameter, tapering only at end and curving mesad distally, covered with widely spaced granules (Fig. 1D) but not ciliate. Interlamellar seta baculiform, unevenly bifid, mostly covered with cerotegument, reaching to about level of bothridial rim when viewed anteriorly, arising from strong tubercle slightly less than seta in height; seta separated by about width of its tubercle from bothridium (Fig. 1C).

Notogaster. Scalps with raised, crenellate margins (Fig. 1B), and mesal tongue-shaped anterior extensions (Fig. 1A), that of tritonymph considerably overhanging prodorsum (Fig. 1C). Notogaster with scalps removed almost circular (Fig. 1E), length (n=1) 290, width (excluding lateral tubes) 250; convex except for intramarginal horseshoe-shaped depression anterior to lateral tubes; alveolate with some pores more marginally (Fig. 1G), alveoli less pronounced in centre; lateral tubes directed only slightly forward, narrowest subdistally and distally expanded into knob-like structure (Fig. 1E), covered with granular cerotegument (Fig. 1D); only 5 pairs of notogastral setae seen, arising from short tubercles, 4 on posterior margin (Fig. 3A), 1 just anterior to fissura *ia* (Fig. 1G).

Ventral morphology. Gnathosoma (Fig. 2A). Seta a long and strong, seta m much less so; seta h short. Chelicera elongate ("pelopsiform"); movable finger with long recurved accessory tooth (at in Fig. 2C); fixed finger with flat sword-like terminally bifid process, probably Tragardh organ, lying in dorsal half of paraxial surface (sp in Fig. 2C). Pedipalp appears similar to *P. pagoda*

FIG. 3. *Solenozetes gallonae* sp. nov. A, setae at posterior of body (from SEM); B, leg I, terminal part, using Grandjean's notation. Scale bars: 50µm.

(Fig. 2F). Rutella forming a tube around chelicerae. Mentum subanteriorly with a strong transverse carina (Fig. 2A,D). Epimeres I-III with strong elevated carinae interrupted mesially (Fig. 2B); epimere I with a more mesial carina separated from more lateral carina; epimere IV with carinae weakly developed; epimeral chaetotaxy 3-?0-3-2. Sharp pedotectal tooth not present but a strong boss ("une forte saille ronde" of Grandjean, 1961: 102) present anterior to leg II. Genitoanal region alveolate adjacent to posterior area of genital plates (Fig. 2D,E); genital vestibule subcircular (Fig. 2E); genitoanal chaetotaxy 6-0-2-3, ad3 preanal (Fig. 2E); anal plates gradually broadening posteriad (Fig. 2G).

Leg 1. Femur with strong crests of cerotegument (Fig. 1C). Solenidion sigma of genu globose terminally but shorter and stouter than in *P. pagoda*; seta d short and expanded subterminally. Seta d on tibia vestigial, lying against and sharing alveolus with piliform solenidion phi 1; phi 2 baculiform. Tarsus with strong proximodorsal crest of cerotegument; solenidion omega 1 ceratiform, omega 2 baculiform; setae tc, u, and a barbed; tc longer than claw. Claw with ventral accessory tooth.

Comments

Setae labelled (Fig. 3B) by positional correspondence to setae in *P. pagoda* (Grandjean, 1961: fig. 3B); solenidia were confirmed optical-

ly, but eupathidic nature of setae p and s not resolved. Ontogeny of setae not studied. Size order of subcapitular setae seems to reflect anteriad hypertrophy of the subcapitulum.

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This research is supported by an Australian Biological Resources Survey grant. I thank Dan Bickel, Australian Museum, Bruce Halliday, C.S.I.R.O. and Roy Norton, State University of New York, for commenting on the manuscript, and Henrik Enghoff of the University Zoological Museum, Copenhagen for the loan of Hammer's *Plasmobates* types. Suzanne Lindsay took the SEMs, Ross Pogson assisted with polarising microscopy and Roger Springthorpe did the camera ready layouts.

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NEW SYNONYMY OF THREE AUSTRALIAN ANTS (FORMICIDAE: FORMICINAE: *POLYRHACHIS*)

RUDOLF J. KOHOUT

Kohout, R.J. 1994 06 01: New synonymy of three Australian ants (Formicidae: Formicinae: *Polyrhachis*). *Memoirs of the Queensland Museum* 35(1): 135-136. Brisbane. ISSN 0079-8835.

Synonymy of three Australian *Polyrhachis* species is proposed (senior names cited first): *P. ammonoeides* Roger = *P. chalchas* Forel; *P. delicata* Crawley = *P. lysistrata* Santschi and *P. hookeri* Lowne = *P. cataulacoidea* Stitz. A lectotype is designated for *P. ammonoeides*. □*Formicidae, Polyrhachis, synonymy.*

Rudolf J. Kohout, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; 20 December 1993.

The species synonymies listed below were recognised during two visits to European and British museums to examine *Polyrhachis* types.

Institutional abbreviations (with the names of co-operating curators) are: BMNH - Natural History Museum, London (Dr B. Bolton); MHNG - Muséum d'Histoire Naturelle, Geneva (Dr C. Besuchet); MNHN - Muséum National d'-Histoire Naturelle, Paris (Dr J.Casevitz Weulersse); MNHU - Museum für Naturkunde, Humboldt- Universität, Berlin (Dr F. Koch); NHMB - Naturhistorisches Museum, Basel (Dr M. Brancucci); NHMW - Naturhistorisches Museum, Vienna (Dr M. Fischer); QMBA - Queensland Museum, Brisbane (Mr E.C. Dahms, Dr G.B. Monteith).

Distribution records are given as 'short' coordinates using 1° grid cell system of Taylor (1987).

SYSTEMATICS

Polyrhachis ammonoeides Roger,1863

Polyrhachis ammonoeides Roger,1863:157. Syntype workers. Type locality: 'New Holland'. MNHN (2), NHMW (1).

Polyrhachis chalchas Forel,1907:307. Syntype workers, female. Original localities: Western Australia, Denham (25/113), Geraldton (28/114), Dongarra (29/114). MHNG (5 syntype workers examined).

LECTOTYPE

Three syntypes of *P. ammonoeides* are similarly pinned and bear identical labels. The MNHN specimens have labels in Roger's handwriting: one with '*Polyrhachis amonoeides* (sic) Roger * Type', the other with '*P. amonoides* (sic)'. The NHMW specimen has two additional labels (1) '*Polych. amonoides* (sic) det. G. Mayr', and (2) 'M.P.' (? Museum Paris). The specimen labelled '*Type' is here selected as lectotype. Other Roger types (e.g. *Polyrhachis latifrons*, *Hemioptica scissa*) suggest that he used asterisks to mark holotype-equivalent specimens. The specimen labels imply that Sydney (=Port Jackson) is the type locality, but the known distribution of *P. ammonoeides* does not support this conclusion.

REMARKS

P. ammonoeides is a ground-nesting ant inhabiting open forests and woodlands; it occurs in Western Australia and adjacent islands: Barrow I. (20/115), Dampier (20/116), Yardie Ck, (22/113), Minderoo (22/115), Kalbarri (27/114), Easter Group Is, Abrolhos I. (28/113), Geraldton (28/114), Dongara (29/114).

Polyrhachis delicata Crawley,1915

Polyrhachis delicata Crawley,1915:238. Syntype workers. Type locality: Northern Territory, Darwin (Hill) (12/130). BMNH, QMBA (2 syntypes examined).

Polyrhachis (Myrmothrinax) lysistrata Santschi, 1920:569. Syntype workers. Type locality: Queensland, Townsville (F.P. Dodd) (19/146). NHMB (1 syntype examined).

REMARKS

Syntypes of *delicata*, *lysistrata* and *queenslandica*, together with a substantial number of specimens from Queensland and Northern Territory indicate that *delicata* is not a synonym of *queenslandica* Emery,1895 as proposed by Crawley (1921) and that *lysistrata* is a synonym of *delicata*. The most obvious difference between *delicata* and *queenslandica* is the direction of

propodeal spines which, in the former, are strongly raised upwards, while in the latter are oblique to the main axis of the body. The body of *queenslandica* is uniformly black, while in *delicata* the head and gaster are mostly dark reddish-brown, with the mesosoma a shade lighter. These characters also distinguish the females of both species. In addition, the median petiolar spine in the female of *queenslandica* is simply pointed, while in female of *delicata* the apex of the spine is emarginate.

Both species are arboreal, using silk to build their nests by joining leaves of various lowland rainforest trees and shrubs. *P. delicata* is known from Northern Territory around Darwin (12/130) and in north Queensland from Mt Finlay (15/145), Cape Tribulation, Kamerunga, Yarrabah (16/145), Mission Beach (17/146) as far south as Townsville (19/146). *P. queenslandica* is apparently confined to the lowland rainforests of north Queensland, ranging from Lockerbie Scrub, Bamaga (10/142) and Iron Range (12/143) on Cape York Peninsula, Cape Tribulation, Kamerunga, Yarrabah (16/145), Bellenden Ker (17/145), Innisfail and Mission Beach (17/146).

Polyrhachis hookeri Lowne,1865

Polyrhachis hookeri Lowne, 1865:334. Syntype workers. Type locality: Sydney, New South Wales; (33/151). ?BMNH (types presumed lost).

Polyrhachis hookeri var. *aerea* Forel,1902:521. Syntype workers, females, males. Type locality: Queensland, Mackay (G. Turner) (21/149). MHNG (2 syntype workers, 1 syntype female examined). Kohout & Taylor,1990.

Polyrhachis cataulacoidea Stitz,1911:377. Holotype worker. Type locality: Sydney, New South Wales (33/151) (Dämel). MNHU (holotype examined).

REMARKS

Stitz was obviously unaware of *hookeri* when describing *cataulacoidea*. The bright green metallic coloration makes them easy to identify and they are straightforward synonyms.

Distribution of *hookeri* was given by Kohout & Taylor (1990).

ACKNOWLEDGEMENTS

I thank the responsible curators, listed above, for access to collections. I also thank the Australian Entomological Society for a Research/Travel Grant. My thanks also go to Kevin Lambkin, Queensland Museum, for reading and commenting on the draft manuscript.

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POLYRHACHIS LAMA, A NEW ANT FROM THE TIBETAN PLATEAU (FORMICIDAE: FORMICINAE)

RUDOLF J. KOHOUT

Kohout, R.J. 1994 06 01: *Polyrhachis lama*, a new ant from the Tibetan plateau (Formicidae: Formicinae). *Memoirs of the Queensland Museum* 35(1):137-138. Brisbane. ISSN 0079-8835.

Polyrhachis lama sp.nov. is described from the Tibetan plateau of Central Asia as the first species of the *P. viehmeyeri*-group recorded north of the equator. It is suggested that species of the group were in the past more widely distributed and that *P. lama* is a relict surviving in isolation on the high plateau of Tibet. □*Formicidae, Polyrhachis, viehmeyeri species-group, new species, distribution.*

Rudolf J. Kohout, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; 20 December 1993.

This new member of the *P. viehmeyeri* species-group is characterised by the absence of pronotal spines, and abundance of distinctly shaggy pubescence beneath the bristle-like pilosity.

Measurements (mm) and indices follow Kohout (1990): TL, total length; HL, maximum head length; HW, head width immediately in front of eyes; CI, cephalic index (HWx100/HL); SL, scape length excluding condyla; SI, scape index (SLx100/HW); PW, pronotal width across humeri; MTL, metathoracic tibial length.

SYSTEMATICS

Polyrhachis lama sp.nov.
(Fig.1)

MATERIAL EXAMINED

HOLOTYPE: Tibet (=Xizang Zizhiqu, China). 'Deutsche Tibet-Expedit. 1938-39 (E. Schäfer)' (worker).

PARATYPES: data as for holotype (4 workers, 1 dealate female).

All in the Forschungsinstitut Senckenberg; paratype worker in Queensland Museum.

DESCRIPTION

Worker. Dimensions (holotype cited first): TL c.8.11, 8.32–8.72; HL 1.93, 1.87–2.03; HW 1.50, 1.47–1.56; CI 78, 75–79; SL 2.31, 2.21–2.40; SI 153, 150–155; PW 1.03, 0.97–1.06; MTL 2.97, 2.87–3.07 (5 measured).

Clypeus with deeply impressed basal margin; median longitudinal carina distinct anteriorly, indistinct posteriorly; median portion of anterior margin dentate laterally. Median ocellus rudimentary, lateral ocelli lacking. Pronotum unarmed; humeri produced into distinct, forward converging dorso-lateral carinae almost reaching the anterior pronotal margin. Promesonotal suture well impressed, metanotal groove rather ill defined. Propodeal spines well elevated, only slightly divergent. Dorsum of petiole convex, anterior and posterior margins obsolete; spines well elevated, divergent.

Clypeus, frontal and lateral areas of head, lateral branches of mesosoma and petiole moderately rugose; rugosity increasing dorsally and posteriorly with dorsa of head and mesosoma fairly coarsely vermiculate-rugose. Gastral dorsum opaque, striate-rugose, with sculpture progressively less distinct posteriorly.

Moderately long, yellowish and reddish bristle-like hairs fairly dense on all body surfaces, including appendages. Silvery pubescence, of distinctly shaggy appearance, rather dense, except on promesonotal dorsum where it is somewhat less abundant.

Generally dark reddish brown with head, mesosoma and petiole on dorsal aspect piceous. Mandibles, appendages and gaster a shade lighter.

Female. Dimensions: TL c. 9.07; HL 1.96; 1.53; CI 78; SL 2.28; SI 149; PW 1.71; MTL 2.97 (1 measured).

Besides the usual characters identifying full sexuality, the general appearance of the available single female resembles the worker very closely. Pronotal humeri with short, ill-defined carinae. Propodeal and petiolar spines shorter, the former slightly, the latter rather more divergent. Sculpturation similar to that of worker, with density increasing from moderately rugose to fairly coarsely vermiculate-rugose, namely on the head and mesoscutum, contrasting sharply with that on mesoscutellum where it is distinctly less coarse with somewhat granular appearance. Bristle-like

FIG. 1. Scanning electron micrograph of the uncoated holotype of *P. lama* in dorsal view.

pilosity is definitely more dense than in worker and abundant shaggy pubescence almost obscures the underlying sculpturation.

Male and immature stages unknown.

REMARKS

Known distribution of the *viehmeyeri*-group is from the Moluccas through Papua New Guinea to the Solomon Islands and northern Australia (Kohout, 1990) but this could be underestimated.

With the description of *P. lama* it appears that the group was in the past more widely distributed and, perhaps, *lama* is an isolated relict. The undeniable similarity between *P. lama* and the *viehmeyeri*-group prototype shows that both probably derived from the same ancestral stock. As noted earlier (Kohout,1990:506), most of this group exhibit variability in the length of pronotal spines even within the same population. Their complete absence and replacement by forward produced carinae, as seen in *lama*, demonstrates their variability to the extreme and can be interpreted as a product of an independent development of the species in isolation.

ACKNOWLEDGEMENTS

Dr J.-P. Kopelke and Wolfgang H.O. Dorow generously provided access to the Forschungsinstitut Senckenberg collection. My gratitude is expressed to the Australian Entomological Society, for a Research/Travel Grant. I thank Dr Kevin J. Lambkin, Queensland Museum, for reading the draft manuscript.

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THE GREEN TURTLE, *CHELONIA MYDAS*, IN QUEENSLAND: POPULATION STRUCTURE IN A WARM TEMPERATE FEEDING AREA.

COLIN J. LIMPUS, PATRICK J. COUPER AND MARK A. READ

Limpus, C.J., Couper, P.J. & Read, M.A. 1994 06 01: The Green Turtle, *Chelonia mydas*, in Queensland: population structure in a warm temperate feeding area. *Memoirs of the Queensland Museum* 35(1): 139-154. Brisbane. ISSN 0079-8835.

Chelonia mydas resident in the Moreton Banks within eastern Moreton Bay, southeastern Queensland, encompass all size classes from immature turtles with a curved carapace length of 39cm to mature adults of both sexes. The population sex ratio is strongly biased to females (66%) and to immature size classes (89% of females, 96% of males). Sexual maturity does not usually occur at the minimum breeding size for the species. Tag recoveries indicate that most of the adult females migrate to breed at the southern Great Barrier Reef rookeries. Individual females do not breed annually. Approximately 10% of the population shows signs of anthropogenic impacts which range from fibropapillomas to propeller damage. Regression equations for converting between the various measurement methodologies for marine turtles are presented for this population. □*Chelonia mydas, Moreton Bay, sex ratio, sexual maturity, migration.*

C.J. Limpus, Queensland Department of Environment and Heritage, P.O. Box 155 Brisbane Albert Street, Queensland 4002, Australia. P.J. Couper, Queensland Museum, P.O. Box 3300, South Brisbane, Queensland 4101, Australia; M.A. Read, Department of Zoology, University of Queensland, St. Lucia, Queensland 4072, Australia; 11 November 1993.

Feeding area studies of *Chelonia mydas* in Queensland began in 1974 at Heron Island Reef (Limpus & Walter, 1980; Limpus & Reed, 1985a; Limpus, 1992a). In 1986, the study expanded to include other study sites in eastern Queensland to investigate the regional population dynamics of the species. The most recent and most southerly study site incorporated into this regional study is in Moreton Bay in southeastern Queensland. This study provides the first systematic assessment of the demography of *C. mydas* in a non-tropical Australian feeding area. The initial phase of this study has been to establish a tagged population of measured turtles for continuing long-term studies. The first results from the Moreton Bay study site are reported here.

METHODS

Turtles were captured using the turtle rodeo capture method (Limpus and Reed, 1985a) in the intertidal flats and the adjacent margins of the Moreton Banks between July 1990 to June 1992. Each turtle was tagged with one or more tags applied in the front flipper axillary tagging positions (Limpus, 1992a). The tags were either large size, 125 CPT titanium turtle tags (Stockbrands Pty. Ltd., Perth, Western Australia. Limpus, 1992a) or inconel 625 turtle tags (National band and Tag Co. New Port, Kentucky; Balazs, 1983).

Curved carapace measurements were taken using a flexible fibreglass tape measure (±0.5cm) laid over the curve of the carapace. These measurements are the standard measurements used for *C. mydas* in eastern Australia by Bustard (1972) and Limpus et al. (1984). The calibration of fibreglass tape measures was checked regularly against steel rules. A tape measure was rejected for use when length changes exceeded ± 0.22cm at one metre. Any large barnacles on the carapace likely to interfere with a measurement were removed.

Curved carapace length (CCL) was measured along the midline from the junction of the skin and carapace above the neck to the posterior margin of the carapace at the midline junction of the supracaudal scutes. Curved carapace width (CCW) was measured perpendicularly to the midline axis of the carapace between the outer extremities of the marginal scutes. This measurement was repeated at several positions to obtain the greatest value. Straight carapace length (SCL) and straight carapace width (SCW) were taken between the same points as the corresponding curved measurements (CCL, CCW) but using a large pair of wooden callipers (Hughes, 1974; Limpus et al., 1983). The width between the tips of the callipers was measured with a steel tape measure (± 0.1cm). Carr's straight carapace length (CSCL) was measured as a straight line

TABLE 1. Frequency distribution of all recoveries of tagged adult female *Chelonia mydas* from Moreton Bay which had been previously tagged while nesting at rookeries throughout the Great Barrier Reef (Limpus et al., 1992; and unpublished records of the Queensland Turtle Research Project). These data include the three recaptures (*) of migrant females from the Moreton Banks of the present study.

Rookery	Breeding Season						
	77/78	81/82	84/85	87/88	88/89	89/90	90/91
Southern Great Barrier Reef rookery region							
LM	1				1*	1	
HI			2			2*	
WI		1	2	1			
NW			1	1*		1	1
Northern Great Barrier Reef rookery region							
RI			1				
Total (n=16)	1	1	6	2	1	4	1

LM = Lady Musgrave Is. (23°54'S, 152°23'E); HI = Heron Is. (23°26'S, 151°55'E); WI = Wreck Is. (23°20'S, 151°57'E); NW = North West Is. (23°18'S, 151°42'E); RI = Raine Is. (11°36'S, 144°01'E).

length from the most anterior to the most posterior projections of the carapace (Carr & Ogren, 1960). This is not a midline measurement. Head measurements were taken using stainless steel vernier slide callipers (± 0.01cm). Head length (HL) was measured from the anterior tip of the maxillary sheath (upper beak) to the posterior margin of the supraoccipital process, keeping the arm of the callipers parallel to the dorsal surface of the skull. Head width (HW) was measured as the maximum width across the skull measured at the quadrate bone. Plastron length (PL) was measured using a flexible tape measure (± 0.5cm) along the midline from the anterior junction of the skin and plastron scutes to the posterior margin of the cartilaginous/bony plate. Tails were measured (±0.5cm) with either a steel or a fibreglass tape measure from the posterior edge of the midline junction of the supracaudal scutes to the tip of the extended straightened tail (TLC). A negative sign for this measurement indicates a distance short of the carapace margin. Turtles were weighed using 10, 100 or 200kg Salter spring balances (± 0.1, ± 0.5, ± 1.0kg respectively).

All turtles were measured for CCL except those with damage to the posterior carapace. An approximately random series of turtles were weighed and TLC measured. A group of immature turtles (31 females and 25 males) was selected from the turtles captured on 25 May and 21 September 1991 so that there were approximately five turtles of each sex represented in each 10cm increment of CCL in the range of 40-90cm and all measurements were taken on these turtles. Each turtle within this two year study has been analysed for only one set of measurements, usually those taken at the time of first capture. The number of turtle barnacles, *Chelonibia testudinaria*, with diameter >1cm on the carapace were counted. Where turtles were recaptured at greater than a one year interval, a second count of these barnacles for the turtle was included.

The gonads and associated reproductive ducts were examined using laparoscopy to assess sex, maturity and reproductive status of the turtle (Limpus & Reed, 1985a). The developmental features of the reproductive organs of marine turtles that can be used for assessment of sex, maturity and breeding status have been described : *C. mydas* (Limpus & Reed, 1985a,b), *Caretta caretta* (Limpus, 1985) and *Eretmochelys imbricata* (Limpus, 1992b). These developmental features were applied in assessment of sex and maturity. The year of breeding was determined as follows: a female was scored as breeding in the current breeding season if she was observed on a nesting beach, or if she was in advanced vitellogenesis in the months preceding a breeding season; she was scored as having bred in the previous breeding season if she had healing corpora lutea (= corpora albicantia) >3mm in diameter during the months following a breeding season; she was scored as having bred in the penultimate breeding season if she had corpora albicantia ~3mm in diameter. Not all turtles were sexed via laparoscopy. For those turtles not sexed via laparoscopy: when TLC >30cm, the turtle was arbitrarily rated as adult male; when CCL <90cm and the tail was not differentiated, the maturity status was rated as immature on the basis that the smallest recorded breeding adult female at the southern Great Barrier Reef (GBR) rookeries had CCL = 90cm (Limpus et al., 1984).

Data were obtained from the unpublished records of the Queensland Turtle Research Project for turtles recaptured in this study which had been tagged at other locations. These recaptures occurred for turtles from three study types.

1. *Feeding area studies.* In a continuing series of studies since 1974, many thousands of *C. mydas* have been captured, tagged and released

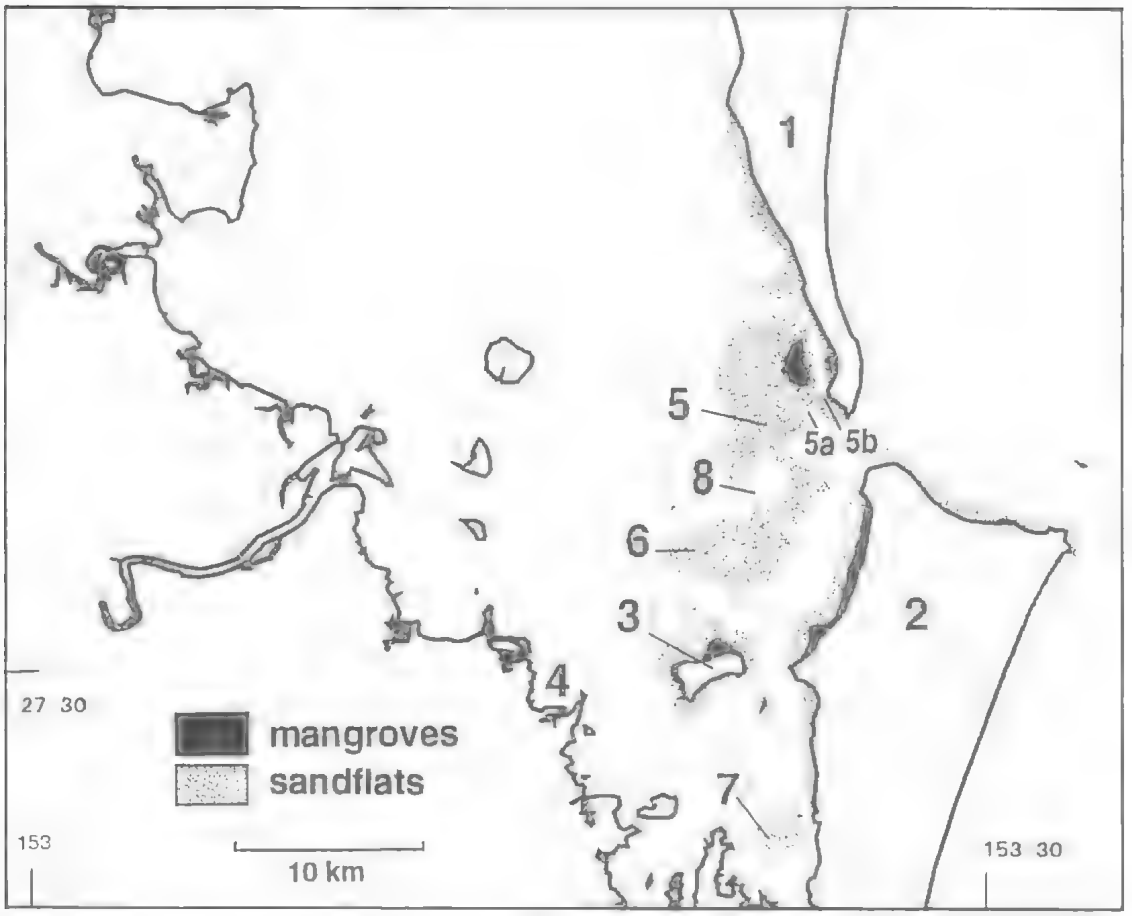

FIG. 1. Moreton Bay and the turtle research study sites, see text for details. 1, Moreton Island; 2, North Stradbroke Island; 3, Peel Island; 4, Raby Bay; 5, Moreton Banks; 5a, Browns Gutter, 5b; Days Gutter; 6, Maroom Banks; 7 , Pelican Banks; 8, Rous Channel.

at Heron Reef and other reefs of the Capricorn-Bunker Groups, Shoalwater Bay, Repulse Bay, Green Island Reef and Clack Reef.

2. *Nesting studies.* Since 1971, tens of thousands of nesting female *C. mydas* have been tagged on nesting beaches in eastern Australia.

3. *Hatchling marking studies.* During the period January 1976 - March 1983, 108940 hatchling *C. mydas* were marked by mutilation tagging at Mon Repos and Heron Island (Limpus, 1985). These latter turtles can be identified to year and rookery of birth by the distinctive pattern of damage to a pair of marginal scutes (one scute on either side of the posterior carapace with symmetrically placed damage within each scute; Limpus, 1985). An arbitrary birth date of 1 February was assigned to these marked hatchlings within each breeding season.

Rainfall and air temperature data were obtained from the Bureau of Meteorology weather station at the Brisbane airport (27°26'S, 153°06'E). Surface water temperature data from the vicinity of the Moreton Banks during June 1988 to January 1990 was supplied by Dr. A. Preen. Water depths were obtained from local marine charts (Anon, 1987).

Study Site

Moreton Bay (27°30'S, 153°18'E) is a large, wedge-shaped, semi-enclosed bay in south eastern Queensland adjacent to Brisbane (Fig. 1). It is approximately 100km long with a maximum width of 30km at its northern limit. It extends from the mouth of the Nerang River at 27°54'S in the south to the opening between Bribie Island and Moreton Island at 27.03°S in the north. Six

FIG. 2. The mean monthly air temperature and rainfall recorded at the Brisbane Airport for the years 1949 - 1992. Data obtained from the Bureau of Meteorology.

FIG. 3. Surface water temperatures recorded on the Moreton Banks. Data supplied by Dr. A. Preen.

rivers discharge into Moreton Bay: Caboolture, Pine, Brisbane, Logan, Coomera, and Nerang Rivers. The southern, narrow, part of Moreton Bay consists of many small islands and narrow channels less than 6m deep (Young & Kirkman, 1975) while the northern portion is relatively open and reaches a maximum depth of 60m (Milford & Church, 1976). The eastern side of Moreton Bay is dominated by a large fan-shaped delta situated between Peel, Moreton and North Stradbroke Islands which is formed by the tidal movement of oceanic waters into Moreton Bay via the Rous Channel. The Moreton Banks form the northern portion of this fan-shaped delta. The sediments of the Moreton Banks are mostly quartz sand in contrast to the southern and western regions of Moreton Bay which are mud (Maxwell, 1970). The open areas of Moreton Bay have salinities close to full-strength seawater (34-35‰), while salinity decreases along the western side of Moreton Bay adjacent to the mainland coast where it approaches 33‰, or lower during floods (Milford & Church, 1976).

Mean air temperatures in Moreton Bay can vary between a maximum of 24.3°C in January to a minimum of 15.9°C in July (Newell, 1971). The range of the air temperature over the bay is narrower than the air temperature range over the adjacent mainland (Fig. 2). The mean monthly surface water temperatures follow approximately the fluctuations of the ambient air temperatures but are generally slightly higher. Mean monthly surface water temperatures in the vicinity of the Moreton Banks range approximately 16-28°C with usually <2°C variation between minimum and maximum temperature within a month (Fig. 3). The Moreton Bay area has a summer wet season during December to March and minimum monthly rainfall during August and September (Fig. 2).

TABLE 2. Immature *Chelonia mydas* captured on the Moreton Banks that had been marked by mutilation tagging when they were hatchlings at the Heron Island Rookery. See Fig. 4 for the marking pattern by which these turtles were identified to the year and rookery of birth after Limpus (1985)

Tag	Sex	Date	CCL(cm)	Age(yr)
T51184	Female	13 Oct 90	54.4	8.75
T47413	Male	10 May 92	68.0	11.25

This part of the Queensland coast is characterised by two tidal cycles per day with a tidal range of ~2.5m at highest spring tides to ~0.9m at neap tides (Anon, 1990). The Moreton Banks are covered in most areas by 2-6m of water at high tide and varying proportions of the banks are exposed at each low tide. The depth of these banks drops sharply to 10m along the southern edge which is delimited by the Rous Channel and to 15m along the western edge. The Moreton Banks cover an area of approximately 6290ha, with some 2513ha of seagrass meadow and another 3777ha of sparse or patchy seagrass (Hyland et al., 1989). The dominant vegetation of the Moreton Banks included: seagrasses (*Halophila ovalis, H. spinulosa, Halodule uninervis, Zostera capricorni, Syringodium isoetifolium*; Hyland et al., 1989), macroalgae (*Sargassum sp., Hypnea cervicornis, Gracilaria edulis, Hydroclathrus clathratus, Codium fragile*) and the grey mangrove (*Avicennia marina*; Dowling, 1986). The latter fringed the eastern margin of these banks and the adjacent small un-named island (27°20'S, 153°24'E).

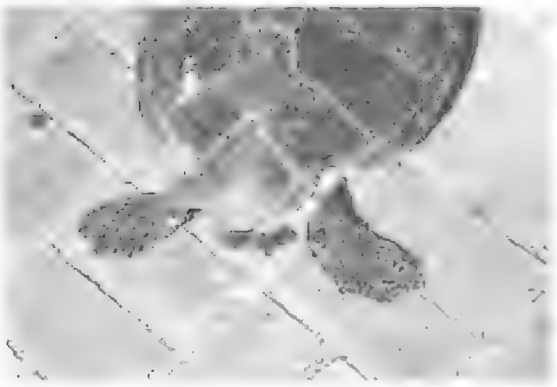

FIG. 4. Immature *Chelonia mydas* (tag number T51184) originally marked by mutilation tagging as a hatchling at Heron Island in February 1982. See Table 2 for details.

To identify capture sites within the Moreton Banks, the banks were divided into sectors which were defined by the boundaries of the low tide drainage areas (Fig. 1).

RESULTS

In the course of establishing tagged study populations, an attempt has been made to capture all turtles seen in shallow water habitats examined in Moreton Bay. Total captures (including recaptures) during this initial two years of study were: 1068 captures of 826 *C. mydas*, 447 captures of 320 *Caretta caretta* and 4 captures of 4 *Eretmochelys imbricata*. This report summarises the data recorded from the *C. mydas*.

A total of 1025 captures of 784 individual *C. mydas* were recorded on the Moreton Banks during this two year study. Numerous turtles were seen and captured on all occasions that the Moreton Banks were visited. No comparable concentration of *C. mydas* has yet been identified in other areas of Moreton Bay during our boat based transects or from discussions with local fishermen. During the last 18 months of the study an additional 42 *C. mydas* were captured elsewhere in Moreton Bay: 10 on the Maroom Banks, immediately south of the Rous Channel; 23 on the northern seagrass flats of Peel Island; 9 on the Pelican Banks. Of the 826 *C. mydas* examined in this study, only 6 were recaptures of turtles that had been tagged in studies elsewhere: 1 from other feeding area studies, 3 from nesting studies, 2 from hatchling marking studies. The ex-feeding area recapture (tag number T36994) was of an immature female that had been tagged while feeding at Heron Island Reef on 31 March 1990 (CCL = 77cm). It was recaptured 490km to the south at the Moreton Banks on 7 September 1991 (CCL = 78.5cm), with 525d between captures. The three adult females from nesting studies that were recaptured on the Moreton Banks originated from tagging studies in the southern Great Barrier Reef (Lady Musgrave Island, Heron Island and North West Island – tag numbers: X14662, T43877, T35025 respectively; Table 1). The two immature *C. mydas* that were consistent with having been marked by mutilation tagging when they were hatchlings had been marked at the Heron Island rookery (Table 2; Fig. 4). These latter turtles have recruited to live at a feeding area that is approximately 490km from their natal rookery.

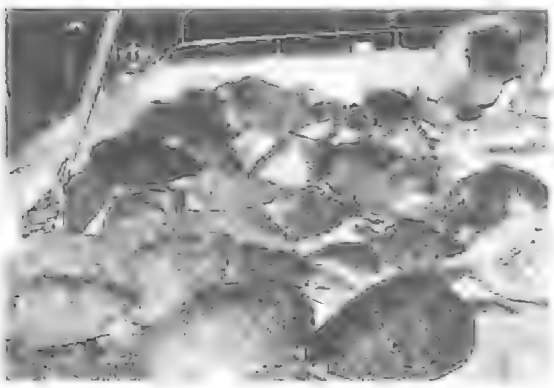

FIG. 5. Portion of a days catch of *Chelonia mydas* from the Moreton Banks onboard the Research Vessel 'Sea World II'.

Because most of the Moreton Bay turtles captured at sites away from the Moreton Banks were not sexed, and given their small sample sizes, only the turtles captured on the Moreton Banks will be analysed for population structure. A typical catch of turtles within this study site is illustrated in Fig. 5. The size class distribution and sex of the 784 *C. mydas* captured on the Moreton Banks is summarised in Fig. 6A. They included turtles over a wide range of sizes from small immature turtles with CCL = 38.8cm up to adults with CCL = 119.1cm. There were no turtles captured in the size range between that of hatchlings (approximate CCL = 5cm; Limpus et al., 1984) and small immatures with CCL = 38cm. The most frequently captured turtles were small immatures in the CCL range of 40-65cm. The population structure by sex, size and maturity is summarised in Fig. 6B,C and Table 3. Of the 393 females examined for sex and maturity, there were 10.9%

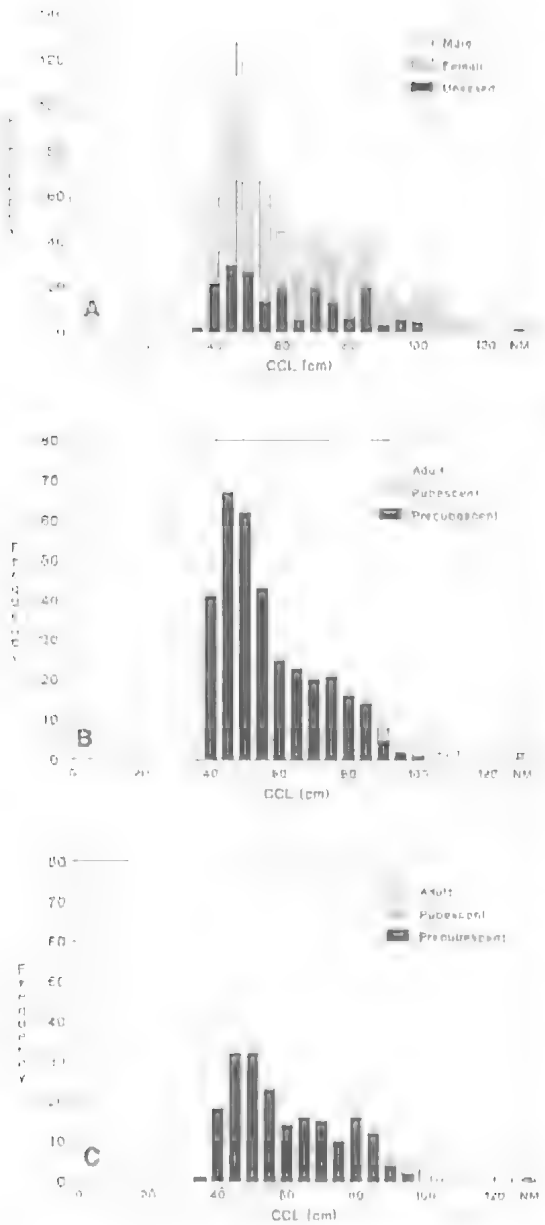

FIG. 6. Size class distribution of *Chelonia mydas* captured on the Moreton Banks. NM denotes that turtles were not measured. A, all turtles by sex (n = 784); B, females by maturity status (n = 393); C, males by maturity status (n = 206).

adult, 2.5% pubescent immature and 86.5% prepubescent immature. The mean size (CCL) of the adult females was 107.9cm (Table 4). This mean adult female size is not significantly different from the mean size of nesting female *C. mydas* from the southern GBR (CCL = 107.0cm, s.d. = 5.318, range = 91-124, n = 1942; $F_{1,1981}$ = 1.07, p 0.5; Limpus et al., 1984). Of the 57 females in the adult size range (CCL ≥ 90cm) that were assessed for maturity, 28% were still immature (8 prepubescent, 8 pubescent). The size (CCL) of the largest prepubescent immature female was 100.5cm while the largest pubescent immature female was 108.1cm, slightly larger than average breeding size for this population. This latter immature turtle was assessed as being several years away from sexual maturity. The mean size (CCL) of pubescent immature females was 96.7cm (Table 4).

Of the 206 males identified in this study, there were 3.9% adult, 1.0% pubescent immature and 95.1% prepubescent immature (Table 3). The mean size (CCL) of the adult males was 102.1cm (Table 4). These adult males were not significantly different to the size of the breeding male *C. mydas* recorded in courtship aggregations in the southern GBR (mean CCL = 100.6cm, s.d. = 4.609, range = 89.5-114.5, n = 361, $F_{1,367}$ = 0.84, p 0.5; Limpus, 1993.). The largest immature male measured (CCL) = 98.8cm. The mean size (CCL) of pubescent immature males was 93.6cm (Table 4).

The results of analysis of covariance, by sex, of the various measurements taken on these turtles are summarised in Table 5. No differences between the sexes, indicated by coincidental regression for males and females, were identified when CCL was compared with each of CCW, SCL, CSCL, SCW, HL or PL and TLC for immature turtles having CCL <80cm. The regressions for this suite of characters were recalculated, pooling the values for both sexes (Table 5; Fig. 7). With each of these pooled regressions, except for CCL:TLC there was little scatter about the relationship as indicated by the high r^2 values. Thus, except for tail length, any one of these measurement methods could be used as a standard measure for this species, and the others could be derived from it. Given the low cost of fibreglass tape measures and the ease with which CCL can be measured in a variety of field conditions, both in and out of water, CCL is recommended as the basic standard length measure for *C. mydas*. *C. mydas* was sexually dimorphic with respect to analysis of covariance comparison of regression analyses of CCL:HW, HL:HW and logCCL:logWT. The results of these analyses by sex are summarised in Table 5. However, the degree of sexual dimorphism is small, as can be seen by inspection of the data (Fig. 7C,D,F), and

TABLE 3. Frequency distribution by size class, sex and maturity for *Chelonia mydas* captured on the Moreton Banks.

Sex	Maturity Status					Total
	Adult	Immature				
		Pubescent	Pre -pubescent(CCL cm)			
			≥90.0	<90.0-≥65.0	<65.0	
Male	8	2	6	72	118	206
Female	43	10	8	94	238	393
Unsexed	11 uncertain status			64	110	185
Total	62	12	14	230	466	784

little confidence can be placed in sexing turtles based on these relationships.

While immature turtle with CCL <80cm were not significantly sexually dimorphic with respect to tail length (TLC), adult turtles were markedly dimorphic with respect to this character (Fig. 7E). However, even with this character there is overlap in measurements with some immature males and small adult females. There were 58 adult-sized, short-tailed turtles that externally resembled "adult female" *C. mydas* that were examined using a laparoscope to determine their sex and maturity. One (2%) was found to be a prepubescent immature male (CCL = 92.0cm, TLC = 7.0cm). Among the 57 females, there were 8 pubescent and 8 prepubescent immatures and 41 adults. Thus if there had been no gonad examination and only the measurement of carapace and tail had been used to determine sex and maturity, the adult female component of the population could have been over estimated by 42%. These data demonstrate that for both female and male *C. mydas*, most do not reach maturity at a minimum breeding size but at a size approaching the average breeding size for the population.

TABLE 4. Curved carapace length (cm) of adult and pubescent *Chelonia mydas* captured on the Moreton Banks.

		mean	SD	n	range
Female	adult	107.9	5.58	41	98.5 - 119.1
	pubescent	96.7	7.54	10	87.7 - 108.1
Male	adult	102.1	2.22	8	98.6 - 105.1
	pubescent	93.6		2	93.2 - 93.9

The 11 turtles scored with "uncertain maturity status" (Table 3) include those turtles with undifferentiated tails that were adult sized CCL>90cm but whose reproductive systems were not examined to assess maturity. These turtles, while they were probably females, have not been assigned a maturity status.

The sex ratio of immature turtles, considered in 5cm CCL size class increments from 40-90cm, was significantly different to 1:1 ($X^2 = 51.02$, 9d.f., $p < 0.001$). Stepwise unweighted logistic regression showed that sex ratio was variable within the population, being significantly correlated with maturity status, size class of the turtle and a cross product interaction of size with maturity status for adult turtles (Table 6). When these data are pooled across all size classes and maturity status classes, it resulted in a sex ratio for *C. mydas* on the Moreton Banks of male : female = 1 : 1.91, i.e. 65.6% of the population was female.

The proportion of adult females that bred in each of four breeding seasons (bred/total number examined) were: 1988-1989 = 1/13; 1989-1990 = 6/15; 1990-1991 = 1/16; 1991-1992 = 2/12. A chi squared test for heterogeneity did not detect significant interseasonal variability in annual breeding rates for these adult females ($X^2 = 7.4$, 3d.f., $p = 0.06$). This result was influenced by the small annual sample sizes. Averaged over these four years, the annual breeding rate = 18% of the adult females that feed in this area. The adult males were not identified to the season in which they bred.

Four immature *C. mydas* were recorded with deformed spines (3 with scoliosis: males, CCL = 70.0, 98.1cm; female, CCL = 50.5cm. 1 with kyphosis: male, CCL = 81.3cm). Fibropapillomas (Fig. 8) were recorded on 62 (7.9%) of the 784 *C. mydas* examined in this study. The frequency distribution by size class of turtles with fibropapillomas is shown in Fig. 9. This disease appears to be externally recognisable most frequently with large immature turtles: average size of turtles with fibropapillomas was CCL = 74.1cm (s.d. = 11.51, n = 62, range = 48.0-102.1) Three other obviously sick turtles that did not swim vigorously and were emaciated and with extremely sunken plastrons (females, CCL = 99.1cm, 41.8cm; male, CCL = 78.4cm) were captured.

The turtle barnacle, *Chelonibia testudinaria*, was the most obvious barnacle on these turtles and was restricted to the more rigid surfaces of the turtles- carapace, plastron and head and oc-

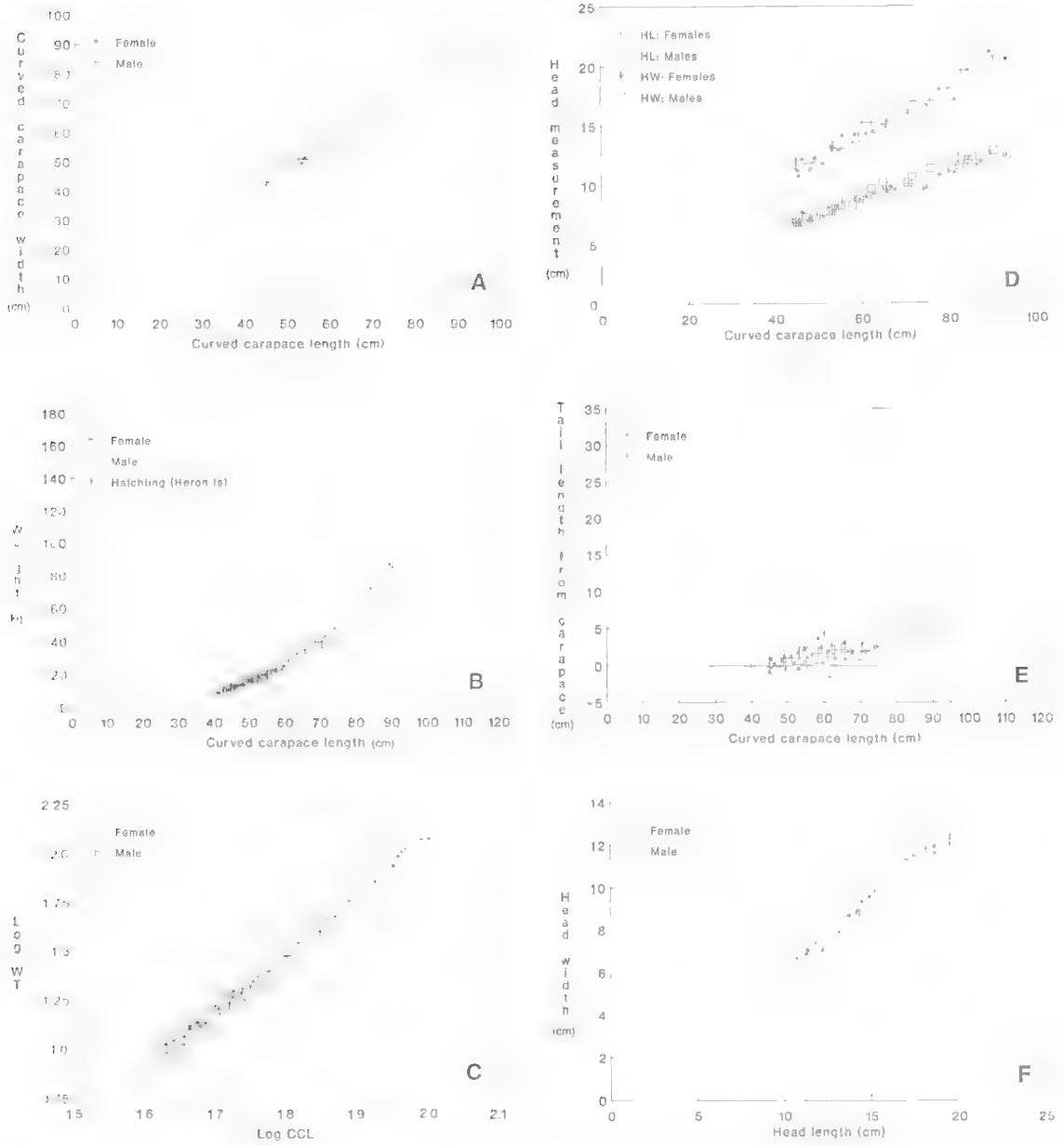

FIG. 7. Scatter plots of morphometric data recorded from *Chelonia mydas* from the Moreton Banks. A, curved carapace length / width (n = 56); B, curved carapace length / weight (n = 198); C, log / log regression of curved carapace length / weight (n = 198); D, curved carapace length / head measurements for the separate sexes (female = 31, male = 25); E, curved carapace length / tail length from the carapace (n = 103); F, head length / head width (female = 31, male = 25).

curred rarely on the flippers. *C. testudinaria* >1cm diameter on the carapace were counted on 814 turtles: this barnacle was recorded on 52.9% of the turtles (mean count of 2.6 barnacles per turtle, s.d. = 5.584, range = 0-93; Fig. 10). There was no obvious correlation between the size of the turtles and the number of *C. testudinaria* >1cm diameter that they carried on the carapace. Two adult female *C. mydas* (CCL = 104.8, 116.6 cm) had large infestations of the burrowing bar-

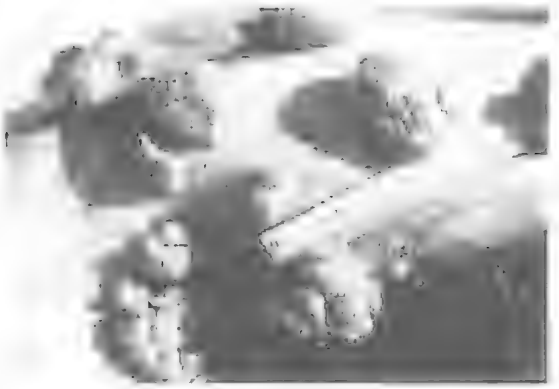

FIG. 8. Fibropapillomas at the base of the front flipper of an immature *Chelonia mydas*. Upper scale in inches, lower scale in centimetres.

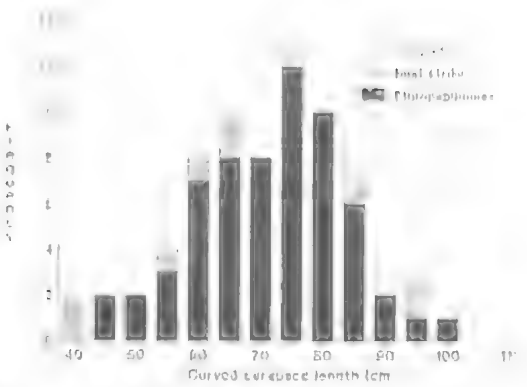

FIG. 9. Frequency distribution by size of sick and injured *Chelonia mydas* from the Moreton Banks

nacle, *Tubicinella cheloniae*, in the carapace. Neither of these turtles appeared to be debilitated by these barnacles. Isolated individuals of this barnacle were found on few other turtles. Other commensal barnacles included *Platylepas decorata* which occurred in appreciable numbers on the skin rather than the rigid surfaces of almost every turtle; the small burrowing barnacle *Stomatolepas transversa* which were found in the plastronal grooves of the larger turtles; *Stephanolepas muricata*, another small burrowing barnacle, occurred in small numbers burrowed through and between scales on the leading edge of the front flippers. Ozobranchid leeches, *Ozobranchus margoi*, and/or their eggs occurred on almost every turtle and were very numerous on turtles with enlarged fibropapillomas. Thirteen turtles displayed evidence of having been impacted by anthropogenic activities (Fig. 9). Four (0.5%) of the turtles had been tangled in rope or fishing line: one (CCL = 89.5cm) had a rope and another (CCL = 94.5cm) had a large length of fishing line tightly tangled around a front flipper (In each case the affected flipper was functional but partly debilitated); two (CCL = 77.2, 85.8cm) were tangled in float lines to crab-pots and would have drowned had they not been released. Nine (1.1%) of the turtles examined had damage to the carapace, in varying stages of healing, that was consistent with the turtle having been struck by a boat or propeller (This value does not include any *C. mydas* that have died following a boat-strike). These turtles with boat-strike injuries (Fig. 9) include almost the entire size range of turtles occurring on the Moreton Banks (Fig. 6A). None of the *C. mydas* examined had unhealed wounds that would have been consistent with their having been attacked recently by sharks or other predators.

Many of the turtles were observed actively feeding and they often had food items still in their mouths as they were lifted on board the catch boat. The common mouth contents, in order of frequency of occurrence, were pieces of seagrass (*Halophila ovalis, Halodule uninervis, Zostera capricorni, Halophila spinulosa*) and algae (*Hypnea cervicornis*). These turtles were also occasionally observed feeding on jellyfish (*Catostylus mosaicus*). A detailed study of the diet of these turtles has been the subject of a separate study (Read, 1991) and will be reported on separately. The turtles foraged into the intertidal areas, moving in with the rising tide and back to permanent water with the falling tide. The turtles had two choices in leaving the intertidal areas with the falling tide; they could move into small gutters within the inner drainage area of these extensive banks or they could swim to the outer edge of the banks. The former was more accessible to turtles that foraged towards the middle of the Moreton Banks. A total of 598 measured *C. mydas* had their location within the Moreton Banks recorded when captured and large and small turtles were found to have different distributions on these banks. Large turtles, CCL $\geq$ 80cm, were rarely encountered on the inner drainage areas (0.5% of captures, n = 192) while they were regularly captured within the outer drainage areas (31.3% of captures, n = 406). There were 241 recaptures on the Moreton Banks of turtles previously tagged on the Moreton Banks during this study. Of these, there were 141 recaptures for which the location within the Moreton Banks was recorded for the consecutive captures of the same turtle. Of these latter recap-

TABLE 5. Analysis of covariance comparison of regression analysis of CCL against other measurements by sex of *Chelonia mydas* resident on the Moreton Banks in eastern Moreton Bay. If there was no significant difference between the sexes when tested for coincidental regression, the measurements for all turtles (male, females and unsexed) were pooled for establishing the final regression in the form : $Y = aX + b$.

Testing for coincidental regression by sex						Linear regression equation							
X	Y	F	DF	sample size ♀♂	P (significance)		a	b	n	r^2	F	DF	P
						For pooled sexes							
CCL	CCW	0.73	2,52	(31,25	p>0.25(ns)		0.9101	2.1956	56	0.9760	2194	1,54	p<0.0005
CCL	SCL	0.64	2,52	(31,25)	p>0.25(ns)		0.9251	-0.1072	56	0.9935	8224	1,54	p<0.0005
CCL	CSCL	0.03	2,52	(31,25)	p>0.25(ns)		0.9089	1.5616	56	0.9855	3666	1,54	p<0.0005
CCL	SCW	0.14	2,52	(31,25)	p>0.25(ns)		0.7143	6.2796	56	0.9820	2933	1,54	p<0.0005
CCL*	TLC	0.12	2,68	(38,34	p>0.25(ns)		0.0977	-4.2958	72	0.4501	57	1,70	p<0.0005
CCL	HL	2.06	2,52	(31,25)	0.25>p>0.1 (ns)		0.1864	2.9980	56	0.9546	1134	1,54	p<0.0005
CCL	PL	1.30	2,52	(31,25)	p>0.25(ns)		0.7591	3.1303	56	0.9652	1496	1,54	p<0.0005
						For separate sexes							
CCL	HW	6.86	2,52	(31,25)	0.0025>p>0.001	♀	0.1183	1.5804	31	0.9677	868	1,29	p<0.0005
						♂	0.1283	1.2369	25	0.9671	675	1,23	p<0.0005
HL	HW	6.62	2,52	(31,25)	0.005>p>0.025	♀	0.6073	0.1670	31	0.9788	1340	1,29	p<0.0005
						♂	0.7015	1.1316	25	0.9713	779	1,23	p<0.0005
log CCL	logWT	3.21	2,259	(176,87)	0.05>p>0.025	♀	2.9297	-3.7929	176	0.9860	>9999	1,174	p<0.0005
						♂	3.0274	-3.9725	87	0.9752	3341	1,85	p<0.0005

* CCL/TLC correlation was tested only for immature turtles with CCL<80cm

tures, 77.3% occurred in the same sector, 18.4% occurred in adjacent sectors within the outer drainage areas, 2.8% involved a shift from the inner drainage to the outer drainage and 1.4% involved a shift from the outer to the inner drainage. There was only one recapture on the Moreton Banks of the 42 turtles tagged elsewhere in Moreton Bay: one of the ten turtles tagged on the Maroom Banks was recaptured on the southern edge of the Moreton Banks, having crossed the Rous Channel. In addition, one of the 23 turtles tagged on the Peel Island seagrass flats was recaptured on the Peel Island seagrass flats. Twenty four immature *C. mydas* were removed from the Moreton Banks and relocated to other areas of Moreton Bay: 9 released at Peel Island with 4 recaptured back at the Moreton Banks; 14 released at Raby Bay with 7 recaptured back at the Moreton Banks; 1 released on the Maroom Banks. The remainder of these relocated turtles have not been recaptured.

While none of the *C. mydas* tagged at the Moreton Banks and released there has been subsequently recaptured at any other feeding area, six of the turtles captured in this study have been found beachwashed elsewhere in the Moreton Bay region. Four apparently have been swept to the east through the Rous Channel (three were found beachwashed and dead on the south eastern end of Moreton Island and one was found beachwashed and dead on the north eastern end of North Stradbroke Island). None of these turtles had external injuries and they were beachwashed along with other similar sized but untagged *C. mydas*. The remaining two were found beachwashed and alive on the western side of Moreton Bay: one displaying disoriented swimming, at Ormiston; the other with four recent propeller cuts to the left shoulder and head, at Victoria Point. This latter turtle was kyphotic and had grown 3.7cm and developed 12 small fibropapillomas in the 1.7yr since it had been first captured.

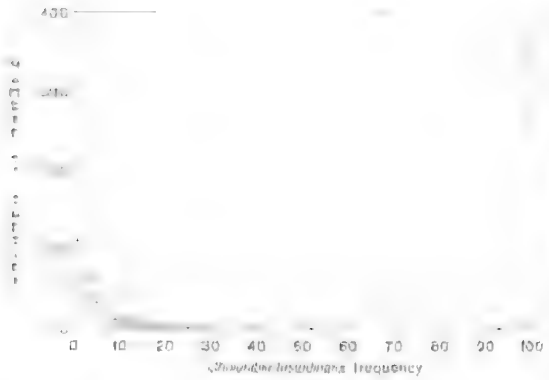

FIG. 10. Frequency distribution of *Chelonibia testudinaria* on *Chelonia mydas* inhabiting the Moreton Banks (n = 814).

In addition, three turtles from the Moreton Banks were killed and used in other studies.

DISCUSSION

The three migrant recaptures of adult females within the present study, when considered in conjunction with other recaptures from elsewhere in Moreton Bay of migrant adult females originating from distant nesting studies (Table 1), demonstrate that the *C. mydas* of Moreton Bay migrate to breed at the rookeries of the Great Barrier Reef. Most of the adult females tagged at nesting beaches and recaptured in Moreton Bay (Table 1) were from the southern GBR rookeries 428-515km distant (94%) while one female had been breeding at Raine Island, 2072km distant in the northern GBR. That the turtles living in Moreton Bay are part of the populations that breed within the GBR is further supported by the recruitment of two small immature turtles to reside on the Moreton Banks that had been originally marked as hatchlings on Heron Island (Table 2). It is within the normal distribution pattern for cheloniid turtles for them to reside at feeding areas that are great distances from their natal rookeries (Limpus et al., 1992).

The capture of T36994 in Moreton Bay during the present study (immature female originally tagged at Heron Island Reef) is the first recapture of a turtle, out of the thousands of *C. mydas* that have been tagged in feeding areas elsewhere in eastern Australia, which has made a major shift in feeding area. However, the results of past mark-recapture studies within the GBR and the Hawaiian Archipelago imply that individual *C. mydas* remain associated with specific feeding sites for extended periods of time (Balazs, 1980; Limpus & Walter, 1980; Limpus et al., 1992). While the isolated instance of movement between feeding sites by T36994 is interesting, it contrasts with the strong site fidelity in evidence in the present study and the local homing to the Moreton Banks of turtles relocated to other parts of Moreton Bay (Similar short range homing has been recorded for *C. mydas* in Bermuda; Ireland, 1979). Until there are additional data to prove otherwise, it is presumed that the majority of individual *C. mydas* remain associated with specific feeding sites.

The oldest museum record of *C. mydas* from Moreton Bay is a skull (Queensland Museum J3841) registered 17 July 1923. Marine turtles were well known to the early aboriginal inhabitants of Moreton Bay who at times hunted them for food (Petrie, 1983). Backhouse (1843), in describing Moreton Bay soon after first European settlement of the area, reported "three species of turtle are met with here, one of which is black and unwholesome". The latter probably was the Leatherback Turtle, *Dermochelys coriacea*. Turtles, especially *C. mydas*, would have been hunted for food for the young colony. Ashton (1941) described a Brisbane scene in about 1880: "In front of one or two of the leading hotels there were enormous turtles chained to the doorpost, with the legend, 'Turtle Soup tonight'". At the turn of the century in Moreton Bay, "... turtles are sufficiently plentiful to attract a little attention. The green turtle, of soup fame, may be found all about the Bay, ..." (Welsby, 1905). A commercial harvest of turtles, presumably *C. mydas*, was occurring in Moreton Bay from at least 1896 (Table 7) and continued until 1950 when *C. mydas* was totally protected in Queensland waters (Limpus, 1980). The Chief Inspector of Fisheries, in eleven of his annual reports to the Queensland Government during the period 1896 - 1924, indicates that there was no shortage of turtles in Moreton Bay (Table 7). However, because of a limited market, the commercial turtle harvest was not great, with the largest recorded annual take probably exceeding 70 turtles in 1900 (Stevens, 1901). During 1924-1929, turtle soup factories operated on North West Island and Heron Island in the southern GBR and at least 8472 female *C. mydas* were taken from the nesting beaches to supply this industry (Anon, 1893-1928; Anon, 1929-1951). Given that *C. mydas* that reside in Moreton Bay are part of the population that nests on these southern GBR rookeries (Table 1; Limpus et al.,

TABLE 6. Results of stepwise unweighted logistic regression of sex ratio by size and maturity of *Chelonia mydas* resident on the Moreton Banks.

			Log-likelihood ratio			
Model	Deviance	d.f.	Source	LR	df	p
S+A+Pu+Pr+SxA+SxPu#	8.28	17				
S+A+Pu+Pr+SxA	8.28	18	SxPr	0	1	p>0.975
S+A+Pu+Pr	14.41	19	SxA	12.3	1	p<0.001*
A+Pu+Pr+SxA	13.53	19	S	10.5	1	0.005>p>0.001*
S+Pu+Pr+SxA	16.96	19	A	17.4	1	p<0.001*
S+A+Pr+SxA	15.17	19	Pu	12.7	1	p<0.001*
S+A+Pu+SxA	8.278	19	Pr	0.004	1	p=0.95
S+A+SxA+C	19.40	18				
A+SxA+C	24.65	20	S	10.5	1	0.005>p>0.001*
S+SxA+C	24.31	20	A	9.8	1	0.005>p>0.001*
S+A+C	25.18	20	SxA	11.56	1	p<0.001*

SxPr dropped from model because it was too highly correllated with other variables.

Dummy variables: A, adult; Pu, pubescent; Pr, prepubescent and cross-products between each of these variables and S. *, source makes a significant contribution to sex ratio; C, constant. S, CCL in 5cm increments.

1992), and given that the southern GBR *C. mydas* population has a mean nesting remigration interval of 6 yr (Limpus et al., in press), the six years of operation of the turtle soup factories on these islands would have reduced the numbers of adult female *C. mydas* in all feeding areas, including Moreton Bay, which supplied females to the southern GBR rookeries.

Following an unsuccessful attempt to produce canned turtle soup on Heron Island, Fogget Jones moved their turtle processing operation to Brisbane in 1927 (W. Golding & Dr. O. Jones, pers. comm.). This Brisbane based turtle soup production continued to utilise female *C. mydas* from the southern GBR rookeries in the years that followed (Anon, 1929-51). It is presumed that this food processing company would have used locally caught turtles from Moreton Bay if they were available but the company's records of turtles and their origins are unavailable. In his 1944 Annual Report the Chief Inspector of Fisheries suggests that only small turtles were captured and brought to the Brisbane market that year, presumably from local sources (Anon, 1929-51). This may reflect a shortage of large turtles at that time. All of the older fishermen working on the Moreton Banks who have been interviewed during the current study indicated that Green Turtles were much less abundant on the Moreton Banks after World War II, i.e. in the late 1940s - 1950s, than they are at the present time.

Although not quantified, there appears to have been some substantial changes in abundance of *C. mydas* in Moreton Bay over the years. The anecdotal information from local fishermen suggests that the *C. mydas* population in Moreton Bay was depleted by the end of World War II and has increased since the introduction of total protection of *C. mydas* for southern Queensland in 1950. If these turtles require in excess of 30 years to reach sexual maturity (Limpus & Walter, 1980), the population resident on the Moreton Banks may represent the result of one generation time of recovery from a depleted state. The small proportion of adults in the Moreton Banks population in the 1990s would be consistent with a population recovering following depletion of adult and large immature turtles resident on the banks in the 1950s. For this interpretation to apply it would require that new turtles recruit to this population at the smaller size ranges and that the turtles do not shift to other distant feeding areas before reaching maturity. In a depleted population of *C. mydas* resident in the Hawaiian Islands, Balazs (1980) described a size structure skewed towards small turtles. The Moreton Banks and Hawaiian populations contrast with the population living on Heron Reef in the southern GBR (Limpus & Reed, 1985a) where

TABLE 7. References to turtles and the turtle fishery of Moreton Bay that are contained in the Annual Reports of the Marine Department (later called the Department of Harbours and Marine) to the Queensland Government, 1893 - 1924.

Year	Comments on the Moreton Bay fisheries
1893-1894	no reference to turtles
1894-95	no reference to turtles
1895-96	report not examined
1896-97	"The turtle fisheries, prosecuted by Mr. Peter Tuska in the Central-Moreton districts, have been found sufficient for the moderate demand of the Brisbane Preserving Works."
1897-98	no reference to turtles
1898-99	"... and turtle are in fair supply when required."
1899-1900	"A good supply of turtle can nearly always be obtained when required."
1900-01	"A very promising trade in turtle has been opened up during the year, several fair consignments having been placed in London and Vancouver by the Brisbane Fish Agency Company, and if regular supplies can be maintained this compay anticipates securing regular orders." The Brisbane Fish Agency Company received "For the year ending 30 June:- .... turtle 70 value £70 ... " (The total catch for Moreton Bay was not documented.)
1901-02	"Turtling which gave promise of developing to a good business last year, has not come up to expectations, the demand being so small, orders for only fifty-three having been received. These orders were soon procured."
1902-03	"Turtle have been plentiful, and the several men following this occupation have been able to supply the demand for turtle."
1903-04	"Turtle-fishing remains an unprofitable occupation, there being next to no demand, a few dozen only meeting all Brisbane requirements. The export trade also appears to be nil, and much to be regretted, a splendid supply being obtainable in our waters could a suitable and steady market be found."
1904-05	"Turtle have also been plentiful in the Bay, but the demand being trifling, only one boat engaged in this trade."
1905-06	"...there is a large field for enterprise in the work of development on the coast of this State, which I fervently hope to see eventually undertaken. Fishing for dugong, turtle, trawling, fish-finning, fish-curing and salting (especially the curing and salting of eugaree) for export, are all open possibilities."
1906-07	no reference to turtles
1907-08	no reference to turtles
1908-09	no reference to turtles
1909-10	"Turtle fishing has not improved, the demand remaining very limited. A fairly plentiful supply is however, obtainable on our coast if required."
1910-11	"Nothing of any note was done with turtle, there being apparently no demand beyond the call for an odd one or so for the Sydney market."
1911-12	no reference to turtles
1912-13	"The demand for turtle has been very limited, although plenty are obtainable, if required."
1913-14	no reference to turtles
1914-15	no reference to turtles
1915-16	no reference to turtles
1916-17	"Turtles have been plentiful, but the demand very limited."
1917-18	"Turtle fishing has not improved. The demand is still very limited, but a good supply is obtainable on the coast if required."
1918-19	"Turtles were obtainable on the coast in any quantity, but there being no demand only a few for odd requirements were secured."
1919-20	"Turtling has been almost a dead letter. Only a few were caught, there being no demand."
1921-22	no reference to turtles
1922-23	no reference to turtles

the Heron Reef population contained a higher proportion of large immature and adult turtles of both sexes. Given that the resident turtles of Heron Reef have not been subjected to any significant harvest since European colonisation (except for the few females that would have nested locally on Heron and North West Islands during the short period of soup factory operations), the structure of the population on Heron Reef in present times should more closely approximate a natural population. The Moreton Bay study site has a lower proportion of adult *C. mydas* in the population than any other study site examined in eastern Australia (CJL, unpubl. data). Given these considerations, there is the strong possibility that the resident *C. mydas* population in Moreton Bay is presently in a state of recovery from past overharvesting.

Moreton Bay is approximately 400km south of the southern limit for successful annual nesting for *C. mydas* in eastern Australia (Limpus, 1980) and the large numbers of *C. mydas* present in Moreton Bay are not aggregations for courtship or nesting. There is only one confirmed nesting record for the species from Moreton Bay: clutch of 126 eggs laid at Scarborough (27°12'S, 153°07'E), hatchling emerged 21 February 1992 (egg in Queensland Museum, J54440). As is characteristic of *C. mydas* populations studied elsewhere in inshore Australian continental shelf waters (southern Gulf of Carpentaria, Limpus & Reed 1985b; Torres Strait, Parmenter 1980; southern GBR, Limpus & Reed, 1985a) posthatchling turtles (CCL <35cm) are not resident on the Moreton Banks. Posthatchling *C. mydas* are believed to drift past Moreton Bay on the East Australian Current and occasionally occur as beachwashed sick or dead individuals on the ocean beaches outside of Moreton Bay following strong onshore winds (Walker, 1994; Limpus et al., 1994). Once the young turtles recruit to Moreton Bay they remain as residents and all size classes occur from the small immatures (CCL = 39cm) up to large adults of both sexes. These *C. mydas* occur in Moreton Bay all year round.

The present study has not attempted to sample the entire range of habitats within Moreton Bay but has focused on shallow water habitats. Given that larger turtles are more likely to be found at the edges of these shallow banks than in the inner drainage areas, the present study may not describe the size class distribution, sex ratio and possibly other characteristics of *C. mydas* inhabiting the deep water habitats of Moreton Bay. Within the shallow subtidal and intertidal feeding areas of the Moreton Banks these *C. mydas* are primarily herbivorous. The population of the Moreton Banks is strongly biased to females (66%) and to immature size classes (89% of females, 96% of males). Sexual maturity for both sexes does not usually occur at the minimum breeding size but at some larger size. Individual females do not breed annually: averaged over the four breeding seasons, 1988 - 1992, only 18% of the adult females were recorded as breeding in any one year.

The turtles of the Moreton Banks, living adjacent to a city of approximately one million inhabitants, show signs of a range of negative anthropogenic impacts: 0.3% tangled in rope or fishing line, 1% with healing boat/propeller damage, 8% with fibropapillomas (fibropapillomas are presumed to be the result of anthropogenic changes in the marine environment (Balazs & Pooley, 1991). These impacts are absent from the *C. mydas* populations feeding on the coral reefs of the southern GBR (Limpus & Reed, 1985a).

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JOHN GILBERT'S MISSING MONTHS

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The activities of John Gilbert, the natural history collector, are examined for the months January - September 1844. Major sources used are his letters, unpublished notebooks and diaries. During this period he spent over a month in Sydney, some of the time writing up his notes. He then travelled overland via the Hunter, Namoi, Gwydir and Domaresq River valleys to the Darling Downs, collecting specimens both en route and at the Downs. Also examined are the details of several type specimens of mammals, birds and fish collected during this period. □ *John Gilbert, John Gould, Frederick Strange, nineteenth century, natural history collectors, type specimens, Darling Downs, Namoi River, Gwydir River.*

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The life of John Gilbert (1812-1845), the natural history collector, is of more than passing interest to modern Australian biologists. He first travelled to Australia in 1838 under the employ of the noted ornithologist John Gould (Sauer, 1982). Gilbert had formerly worked with Gould at the Museum of the Zoological Society of London from 1828 to 1836 (Torrens, 1987). By 1838, Gould was no longer working for the Zoological Society and was compiling information for his folio monograph, 'The Birds of Australia' (Sauer, 1982). He began publishing a folio work on Australian birds the previous year but soon recognised he needed more information to make it complete (Sauer, 1982; McEvey, 1979). Gould, perhaps realising that he was not in a position to visit and collect specimens in all the accessible parts of the continent himself (Chisholm, 1941), employed John Gilbert some time before April 1838 (Torrens, 1987)

Gould and Gilbert separated in early February 1839, just over a month after reaching Tasmania. Gould collected specimens in the eastern colonies while Gilbert travelled on to Perth in Western Australia and eventually to Port Essington, now in the Northern Territory. As these areas were never visited by Gould himself, Gilbert's observations were often quoted in Gould's works, while many of the specimens Gilbert collected were designated type material by both Gould and later authors (e.g. Stone & Mathews, 1913; Thomas, 1921; de Schauensee, 1957; Warren, 1966; Warren & Harrison, 1971). Indeed Gilbert was the first to collect as many as eight percent of the higher vertebrates of Australia (Fisher, 1992).

Gilbert returned to England in September 1841 and less than five months later was again sailing for Australia. On his second visit to Australia, he spent eighteen months in Western Australia before coming to the eastern States in early 1844 (Whittell, 1942b). Later in the year, while visiting the Darling Downs, he joined Ludwig Leichhardt's private expedition to Port Essington. On the evening of 28 June 1845, the Expedition was camped near the base of Cape York Peninsula (Leichhardt, 1847). They were attacked by a group of Aborigines, possibly because they were intruding on an Aboriginal ceremonial ground then in use (Roderick, 1988). Gilbert was speared as he was leaving his tent and died almost immediately.

Given the interest in Gilbert's activities and collections, it is surprising that there is a period of his second visit to Australia, from 30 January to 18 September 1844, that has been both misinterpreted and largely ignored by his biographers.

The first to discuss this period was A.H. Chisholm, who in 1940 noted that from February to August 1844, Gilbert '*worked north through New South Wales up to the Darling Downs of the present Queensland*'. The following year he modified this to '*worked north overland*' (Chisholm, 1941). Later, Whittell (1954a) did not know whether Gilbert travelled to the Darling Downs by sea or land, while Sauer (1982) modified Chisholm's version slightly to say that Gilbert collected, but omitted to state that he had travelled overland. Webster (1980) suggested that Gilbert travelled by coach and dray from Newcastle to the Darling Downs via Cassilis when '*horses had not been kept for him at an inn*'. Finally Albrecht & Albrecht (1992) noted that he

spent a short time with Stephen Coxen in the Hunter region collecting specimens and then travelled north to the Darling Downs.

Chisholm (1941) and Webster (1980) attempted to use Gilbert's diaries of the Port Essington Expedition to trace his movements for this period. Chisholm recovered these two volumes from Gould's decendants in 1938 and lodged them in the Mitchell Library, State Library of New South Wales (hereafter ML). Gilbert's account of the Port Essington Expedition was largely written in ink and take up most of the contents of the volumes. His notes for the earlier period in the eastern states takes up part of the first volume, but are in pencil and are now difficult to read. Close examination of the contents of these diaries reveals a number of errors made by both Chisholm and Webster. These errors have been compounded by those who have used these publications as secondary sources. Therefore this paper is an attempt to clarify some of Gilbert's movements during the period concerned, and to give some details of the animals he encountered.

GILBERT'S SECOND VISIT TO AUSTRALIA PRIOR TO MARCH 1844.

Gilbert arrived back in London from his first trip to Australia in mid-September 1841, (letter from Gilbert to Gould 17 September 1841 in ML), but Gould was obviously anxious for more material as Gilbert left London for Australia on 2 February 1842. He arrived in Western Australia on 17 July 1842 and remained collecting specimens until 20 December 1843, when he left for Sydney via Launceston. He arrived in Sydney on 30 January 1844 on the 155 ton brig 'Union' (Anon, 1844a; Chisholm, 1940; Whittell, 1941, 1942a,b, 1951).

Little is known of Gilbert's movements during his extended stay in Sydney. At some stage between 13 January and 27 March he met the naturalist John MacGillivray (Whittell, 1945). It was stated by Loch (1989) that Gould, Gilbert, and MacGillivray had all stayed in Sydney at the boarding house kept by the wife of another naturalist, Frederick Strange. Loch obtained this information from an undated note written by the late Tom Iredale in the Australian Museum (I. Loch, pers. comm.). Iredale had been informed of this by the conchologist John Brazier who was related to a later associate of Strange, J.C. Rossiter (Whittell, 1947). However Brazier's story is not entirely correct for Gould stayed at George Bennett's house on his first two visits to Sydney (Hindwood, 1938; Sauer, 1982). It is also doubtful whether Strange had even visited the city before Gould left in early April 1840, though he was certainly in Sydney later in the year (Whittell, 1947; Sauer, 1982).

Strange's wife took in boarders, as shown by the theft of a jacket and a pocket-book containing some money from *'a young man named Laurence Carearman, residing at Mr. Strange's, Princes-street'* in January 1845. (Anon, 1845). Princes Street no longer exists, having made way for the southern approaches to the Sydney Harbour Bridge.

Gilbert did meet Strange and his wife while in Sydney and stayed at least part of his time at Strange's house. On 22 February 1844 Strange wrote to Gould: *'Mr Gilbert is now stopping with me in Sydney'* (Fisher, 1992; letter in British Museum (Natural History) [hereafter BMNH] General Library, London). MacGillivray was apparently also present at the time, for on 4 June 1844 Strange wrote to Gould: *'H.M. ship Fly have now been away about three months and Mr MacGillivray is gone in her he used to stope with me when he was in Sydney and Mr Gilbert have been gone about the same time Beyong New England and I have not heard of him since he left'* (Fisher, 1992; letter in BMNH). MacGillivray himself later recorded that he, *'saw much of him* [Gilbert] *a few months before his departure on his last and fatal journey'* (MacGillivray, 1846). Gilbert was evidently on friendly terms with Strange and his wife. Gilbert wrote to Strange from the Darling Downs on 16 September 1844, and amongst other matters left his *'Best respects to Mrs. S.'* (Whittell, 1947).

Gilbert wrote at least one letter to Gould during March (his letter No. 16; Chisholm, 1940). He was still in Sydney on 4 March 1844, for on this date J.B. Jukes wrote from Sydney to his aunt, *'I go with him* [George Bennett] *and Gilbert (Gould's agent and collector) to look at some gigantic bones from New Zealand this evening'*, (Jukes, 1871).

Gould and Bennett were close colleagues. Gould had stayed at Bennett's house in April and September 1839 (Hindwood, 1938; Sauer, 1982) while Bennett later became Gould's agent in Sydney (letter from Gould to Bennett dated 18 December 1844 in ML). Gilbert also received *'assistance and advice'* from Bennett in May 1840, on his earlier visit to Sydney (letter from Gilbert to Gould dated 4 May 1840 in ML). He wrote to Bennett on 10 September 1844 giving

details of Ludwig Leichhardt's forthcoming expedition to Port Essington (letter in Leichhardt papers ML; Whitley, 1938). In this letter he asked Bennett to forward his mail from Sydney to Port Essington. This suggests that Bennett's house had been used as a forwarding address by Gilbert. In the same letter is the information that Strange told him that Gould had not written, so either Strange had spoken to Bennett or Strange's house was also a forwarding address.

Before Gilbert departed for Australia, Gould gave him instructions to collect specimens at the Illawarra, the lower Hunter and near "Yarrundi" in the Upper Hunter, the property of Stephen Coxen, Gould's brother-in-law (Longman, 1922). Accordingly, Chafer (1992, pers. comm.) inferred that Gilbert visited the Illawarra at some stage, but there is no proof of this. The only indication that Gilbert may have done any fieldwork is a postscript in Strange's letter to Gould of 22 February 1844 that: *'I and Mr Gilbert are going to Brooken Bay* [=Broken Bay] *after some Wallarroo* [=Common Wallaroo, *Macropus robustus*]' *(Fisher, 1992; letter in BMNH). Whether Gilbert and Strange actually went to Broken Bay is not known, as there is no written account of such a visit, nor can any specimens from this fieldwork be identified (C.T. Fisher, pers. comm.).*

Examination of Gilbert's notebooks held by the Queensland Museum and the pencilled notes in his diary, suggests that Gilbert was probably occupied for most of his stay in Sydney, appending information into his notebooks from recently published works on Australian animals. These notebooks were used by Gilbert as a field guide to the species he was likely to encounter. They were discussed by Whittell (1951, 1954b) who also concluded that they were used to record information on the species already observed by Gilbert.

In 1839 on his first visit to Western Australia Gilbert had a copy of Gould's 'Synopsis of the Birds of Australia' (Whittell, 1941). This apparently was insufficient for Gilbert's fieldwork, for on 4 May 1840 he wrote to Gould from Sydney; *'You have left me a very long list of desiderata, but here again your haste has caused you to commit an oversight, in leaving me so long a list of scientific names without anything in the least explanatory, you must be aware that a very great number of these Birds I have never seen & unfortunately for the want of Knowledge of Latin I must remain in utter ignorance of a great many of them, but such of them as are to be seen in the Museum I will endeavour to make myself acquainted with* '(letter in ML). Shortly after Gilbert visited the Australian Museum, which at the time had Bennett as Secretary and Curator (Strahan, 1979; Whittell, 1942a; letter from Gilbert to Gould dated 15 May 1840 in ML).

On Gilbert's second visit to Australia he needed a better guide for use in the field, and the notebooks now held by the Queensland Museum appear to have been compiled by Gilbert for this purpose. His notebook on birds runs to 681 pages. In addition at the beginning there is an 18 page index to the names in the book and a table of distribution. This index, in conjunction with the details of the plates included in the notebook proper, gives some idea of when it was written.

The size of the pages of these notebooks is 185 x 275mm, which is the size of the plates in Gould's 'Synopsis of the Birds of Australia'. The index is smaller at 180 x 260mm. The larger pages were trimmed at least once during binding as the page numbers handwritten in the top corners were cut off in the binding process. The plates interleaved with the text in the notebook are largely derived from Gould's 'Synopsis', and Whittell (1951) was incorrect when he said that most of the remainder are from Gould's 'Birds of Australia and the Adjacent Islands'. Eleven plates come from this work, those of the Spine-tailed Swift *Hirundapus caudacutus* [plate letterpress as *Chaetura macroptera*], Rufous Whistler *Pachycephala rufiventris* [as *Pachycephala pectoralis*], Elegant Pitta *Pitta elegans vigorsii* [as *Pitta vigorsii*], Variegated Fairywren *Malurus assimilis lamberti* [as *Malurus lamberti*], Red-winged Fairywren *Malurus elegans*, Zebra Finch *Taeniopygia guttata* [as *Amadina castanotis*], Star Finch *Neochmia ruficauda* [as *Amadina ruficauda*], Spotted Bowerbird *Chlamydera maculata* [as *Calodera maculata*], Blue Bonnet *Psephotus haematogaster* [as *Platycercus haematogaster*], Budgerygah *Melopsittacus undulatus* [as *Nanodes undulatus*] and Black Honeyeater *Certhyonix niger* [as *Myzomela nigra*]. The bulk of the remainder actually come from Gould's 'Birds of Australia', although they were cut from their folio size to that of the *Synopsis* plates. As a consequence, some birds pictured on the folio plates have been removed. For example, in Gilbert's notebook the plate of the Rainbow Bee-eater *Merops ornatus* has only one bird pictured, that of the lower bird in the folio plate.

These plates serve as a useful illustration of Gould's procedure in publishing his monographs

since Gilbert was probably given copies of all available plates of Australian bird taxa during the few months he was in London. Of these plates, there are:

a) seven coloured and six uncoloured plates from Parts I-V which were published before Gilbert left London [note the plates of the Rufous Whistler, Elegant Pitta and Black Honeyeater are not counted here as they are identical in Gould's 'Birds of Australia and the Adjacent Islands' and his 'Birds of Australia', evidence of Gould re-using his lithographic stones (McEvey, 1979). For the publication dates of Gould's folio works see Waterhouse (1885), Sauer (1982) and Sauer & Evans (1989)];

b) 12 uncoloured plates and one partly coloured plate which were scheduled to be published in Part VI on 1 March 1842, one month after Gilbert left for Australia. The partly coloured plate is the Scrubfowl from Port Essington, *Megapodius tumulus*, which has only the bird painted;

c) three uncoloured plates and one partly coloured plate (the Rose-crowned Fruit-dove from Port Essington, *Ptilinopus ewingii*) which were scheduled to be published on 1 June 1842 in Part VII; and

d) an uncoloured plate of *Estrelda bella*, [*Stagonopleura bella*, Beautiful Firetail] from Part XVIII which was scheduled to be published as late as 1 March 1845. The plate itself lacks the letterpress and has the scientific name inscribed in Gilbert's hand.

Gould had most of the plates at hand for the next Part to be published (most Parts had 17 plates), as well as some that were to be published many months and even years later. The Rose-crowned Fruit-dove was formally described after Gilbert left for Australia. The partly coloured plate of this bird is signed in paint 'HCR', that is Henry Constantine Richter, who was the principal artist first employed by Gould in 1841 after the death of Gould's wife. Indeed, the first plates drawn by Richter were those in Part VI (letter from E.C. Prince, Gould's secretary, to Rev. Ewing, 30 December 1842 in ML; Sauer, 1982). In the index '*Ptilinopus ewingii*' is written in thicker pen, suggesting that Gilbert added the name later, having overlooked the letterpress when originally creating the index. Most of the layout of the notebooks and insertion of the plates, was probably done by Gilbert in London between September 1841 and February 1842. An indication that this was the case is the description of *Meliphaga longirostris*, the Western Australian subspecies of New Holland Honeyeater *Phylidonyris novaehollandiae longirostris*, which was included in the notebook and mentioned in Gilbert's list of specimens sent back to England from Western Australia in early 1844 (Whittell, 1942b). This subspecies was not described until November 1846 (Gould, 1846b), and the fact that Gilbert had listed it, but did not include a plate, suggests that Gould had personally told Gilbert his intention of naming the bird when Gilbert was in London.

The index itself was written at different times, though it is entirely in Gilbert's hand. Most of the contents were written with a fine pen, though some parts, notably corrections and additions, were written with a thicker pen. The fine writing in the index and table of distribution must have been written after mid-March 1843 as the locality '*Abrolhos* [=Houtman's Abrolhos]' is included in fine ink. Gilbert visited these islands off Western Australia between 6 January and 20 March 1843 (Whittell, 1942a,b). The changes in thicker pen in the index are not great in number. They are often alterations to the genera or new names given to descriptions originally referred to only by genus. Each of the changes can be traced to the Gould publications appearing after Gilbert's departure for his second visit to Australia. Most of these changes are found in the various Parts of Gould's 'Birds of Australia', however five are found in three papers in the 'Proceedings of the Zoological Society of London' (Gould, 1842f, i, 1843a). The last of the changes are those that occurred in Part XI of Gould's 'Birds of Australia'. This was scheduled to be published in London on 1 June 1843 thus the index must have been corrected some months after this date.

When discussing the notebooks, Whittell (1951) only gave information concerning those species recorded from Western Australia. Gilbert's notes from the second trip are almost entirely confined to observations from this State. In all cases references to observations are made in the past tense. There are some notes on the birds from the Port Essington area, but these refer to his previous visit to Australia. For those species restricted to the east coast there are no additional notes beyond the descriptions of the animals. So it appears that Gilbert wrote these notebooks prior to collecting on the east coast.

New names and descriptions, as well as Gilbert's observations on the species recorded in Western Australia (including mammals, cf. mammal notebook; Whittell, 1954b), were added later. Whether he wrote any of this in Western Australia

is unclear. Apart from the Governor, John Hutt, there were no subscribers to any of Gould's works in Western Australia at the time, nor had Gilbert been able to interest any additional subscribers (see letter from Gilbert to Gould dated '*15 December 1842* [=1843]' in ML; reprinted in Whittell, 1942b). Gilbert was unlikely to have had access to the new parts of Gould's folio editions in Western Australia, let alone the 'Proceedings of the Zoological Society of London'. The changes to the index were probably written in Sydney from Bennett's copies of the relevant parts of the publications concerned. Bennett was a subscriber to all of Gould's folio works (Sauer, 1980) and he also had an extensive library of scientific literature, Bennett's bookplate being found in many volumes in libraries around Sydney (pers. obs.). Given the quantity of material that Gilbert wrote, he may have spent a large part of his time in Sydney transcribing notes from George Bennett's copies of Gould's publications. This would have left him little time to collect specimens.

As noted by Whittell (1951, 1954b), there is another index in the Queensland Museum Library to a notebook on kangaroos, similar to the bird index, also written in Gilbert's hand. The whereabouts of the kangaroo notebook is not known, but it was probably a similar layout to the bird notebook. Part I of Gould's 'Monograph of the Macropodidae' was scheduled to be published in August 1841, though it may have been delayed until late September (Sauer, 1982), while Part II appeared in early May 1842. As Gilbert was given copies of bird plates scheduled to be published in June 1842, it can be assumed the kangaroo notebook compiled by Gilbert included most of the plates from the macropodid monograph. This may mean that the kangaroo notebook was the size of the original folio plates and may have been cut for its lithographs at a later stage.

GILBERT'S PENCILLED NOTES IN HIS DIARIES OF THE PORT ESSINGTON EXPEDITION.

Gilbert's diary of Leichhardt's Port Essington Expedition was written in two volumes. In the first there are a number of pages written in pencil with the bulk of the diaries written in ink. Chisholm (1941) referred to the pencil section as merely '*pencilled notes of various kinds*'. These pencilled notes are extremely difficult to read and a large proportion of them are illegible. When the diaries came to the Mitchell Library in 1938 a typescript copy was made. However the transcriber obviously had difficulty reading the pencilled section and this was never typed.

In deciphering the Gilbert diary I have used both microfilm and photocopies of the relevant volume. This particular volume has been missing since at least 1985. By using microfilm on the reader under varying intensities of light and degrees of magnification, it has been possible to read a fair proportion of the pencilled notes. When quoting from a passage I have followed the convention of citing an illegible word as: [blank]. Words that are inferred, or probable, are inserted in square parentheses and followed by a question mark. All punctuation and spelling is as close as possible to Gilbert's original.

Chisholm also had difficulty reading the pencilled notes in the diaries. He mentioned in a footnote to his 1944 paper: '*For my own part, I read much of the diary in the original in England, but have worked upon it subsequently from a typed version copy supplied by the authorities of the Mitchell Library, Sydney, to whom the document was presented*'.

In the same paper Chisholm discussed Gilbert's notes on a Flock Bronzewing *Phaps histrionica* collected on Leichhardt's Port Essington Expedition. Chisholm referred to it as: '*a beautiful species certainly, but one that he* [Gilbert] *had seen previously on the Namoi Plains*'. Gilbert's diary for the day in question (23 April 1845) notes in ink: '*it is a beautiful species certainly, and I have seen it before on the Namoi plains*'. Chisholm's almost verbatim quote of Gilbert's diary inadvertently shows that Chisholm did not read the relevant section in the pencilled notes. Chisholm went on to discuss Gould's records of the species from the Namoi in 1839-40 and gave no further details of Gilbert's sightings from the same area. Gilbert recorded Flock Bronzewings a number of times in his pencilled notes (see below) and this deserved more than a passing mention.

The first part of the pencilled notes consists of a series of descriptions of mammals, birds and fish, largely from the east coast and Port Essington areas, which originally ran to 59 pages of text. These mammals and birds are all identified by scientific name, and some of them had been described by Gould from material sent to London by Gilbert on his first trip to Australia. The accounts that can be read are of species described in Parts VI to IX of Gould's 'Birds of Australia' and Part II of his 'Monograph of the

Macropodidae', as well as mammals and birds described in Gould's papers given at the meetings of the Zoological Society of London during the first ten months of 1842 (Gould, 1842c,d,f,g,h,i, 1843a) and Gould's paper describing *Macropus ocydromus* [*M. fuliginosus*, Western Grey Kangaroo] and *Lagorchestes albipilis* [*L. fasciatus*, Banded Hare-wallaby] in the 'Annals and Magazine of Natural History' (Gould, 1842e). Gilbert also listed *Perameles harveyi* [*Bettongia lesueur*, Burrowing Bettong] and *Phascogale albipes* [*Sminthopsis murina*, Common Dunnart] described by G.R. Waterhouse at the meeting of the Zoological Society of London on 8 March 1842 (Waterhouse, 1842), and *Phascogale leucopus* [*Sminthopsis leucopus*, White-footed Dunnart] and *P.*[*hascogale*] *apicalis* [*Parantechinus apicalis*, Dibbler] described by J.E. Gray in the 'Annals and Magazine of Natural History' during 1842 (Gray, 1842a,b). In most cases the species are listed exactly in the order the species were published in these works (comparisons made with unbound ML sets of the folio works).

Amongst the notes there is also a page and a half of brief list of fish names, both scientific and Aboriginal. These names are numbered and correspond with numbered specimens collected by Gilbert at Port Essington and Timor in 1840 and 1841. These fish were described in a series of papers published by John Richardson in 1842 (Richardson, 1842a,b,c). Richardson published five further papers in the 'Annals and Magazine of Natural History' based on the fish collected by Gilbert from Port Essington. Later in the list of descriptions Gilbert wrote the first name from the next of Richardson's papers, *Gerres filamentosus*, (Richardson, 1842d), but crossed it out. The fact that Gilbert does not list the later fish names suggests that he decided that there was little value in listing them without descriptions. The order of Gilbert's notes imply that he was systematically extracting the descriptions of Australian species of mammals, birds and fish from the available scientific literature and Parts of Gould's folio works that were published after he left for Australia.

Given the volume of material extracted from journals, it appears that these notes were also written while he was in Sydney. Another indication that this was the case is that there is the note:'*Andrew Carr*[,] *Cumberland Street*' amongst the descriptions. There is no Cumberland Street in Perth. Cumberland Street, Sydney, still exists and in 1844 was the street parallel to Princes Street. Although I have been unable to find any mention of an Andrew Carr of Cumberland Street from this period, there is a Richard Carr listed in the electoral roll for this address in 1844 (Anon, 1844i) Given the constraints for voting at the time, Richard Carr must have owned property here, while Andrew Carr may have lived at the same address.

The descriptions in the diary would have been written by Gilbert for identification purposes, much like the notebook on birds in the Queensland Museum (as previously discussed). The fact that they were transcribed into the diary could suggest that when Gilbert left Sydney for the Darling Downs he may have decided to leave the Queensland Museum notebooks with Bennett or Strange, though he could have equally taken them as far as the Darling Downs and left them with the Coxens.

Some of the pencilled descriptions in the diary have been covered by ink. When Gilbert ran out of space in the second volume he started writing in ink over the top of the descriptions in the first volume. Consequently the first ten of the 59 pages have been covered with diary notes from June 1845. Three pencilled bird names can be read amongst the ink notes, *Petrophassa albipennis*, *Grallina australis* and *Phalacrocorax leucogaster*, which were pictured in Parts X and XI of Gould's 'Birds of Australia'. There were undoubtedly further descriptions of birds from this work, though the original notes are no longer legible. Gilbert's untimely death prevented him from obliterating all the pencilled notes.

After these descriptions the diary entries begin in pencil and amount to 21 pages of text before Gilbert's account of the Port Essington Expedition begins in ink. In addition, there are a few pages of pencilled notes at the end of the volume. These refer to the collection of specimens, both before and during the Port Essington Expedition; Gilbert's diary notes for exploratory excursions away from the main party during the Expedition; and his initial attempt at a diary of the Port Essington expedition before he used pen and ink. Unfortunately many of these notes are illegible, with some of them out of chronological sequence.

GILBERT'S JOURNEY TO THE DARLING DOWNS

Gilbert's diary begins on 18 March 1844, when he noted that he left Sydney at 10 at night on the steamer 'Rose'. The following morning it travelled along the lower Hunter River (Fig. 1). Gilbert recorded in a footnote: '*The banks were*

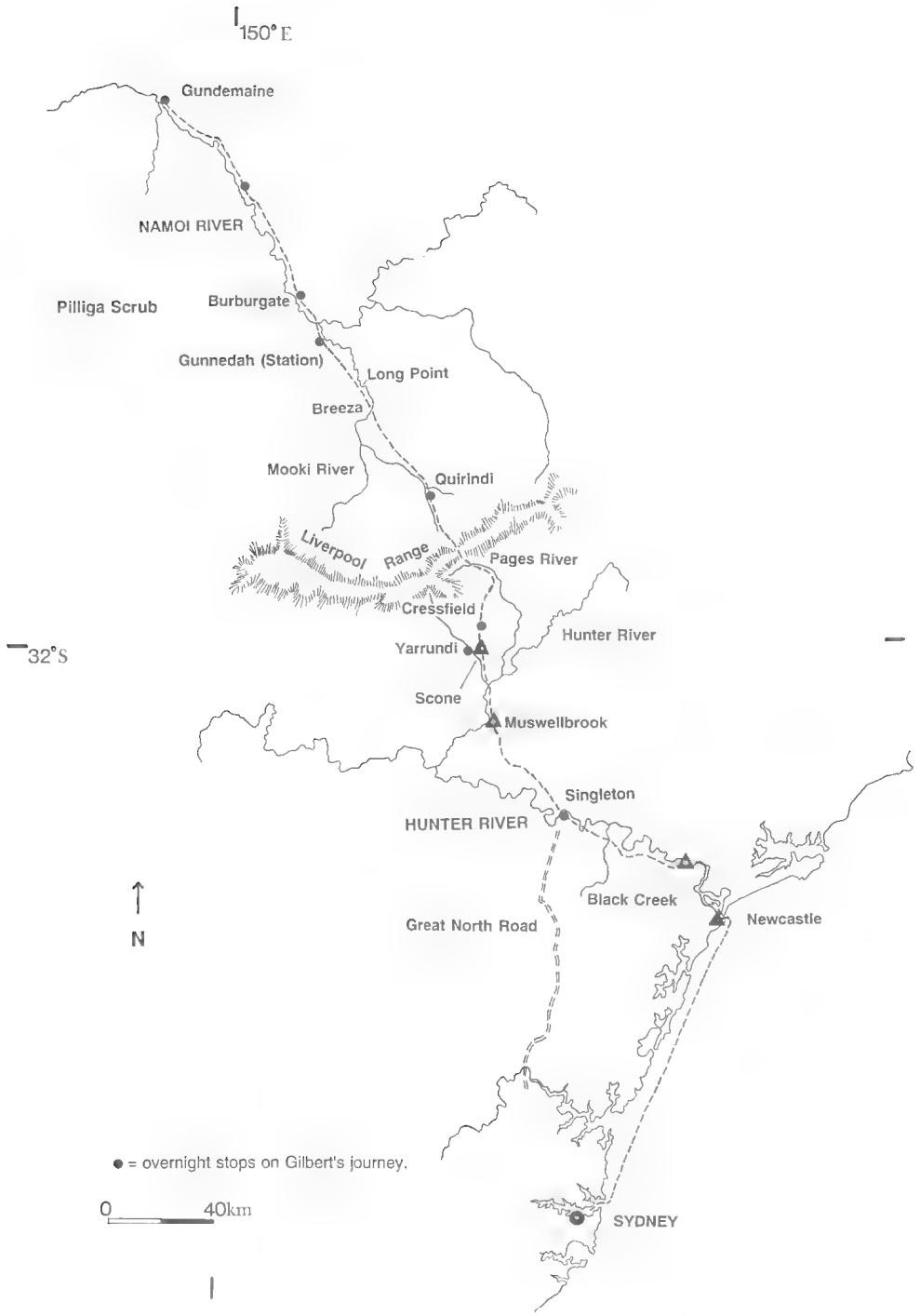

FIG. 1. Gilbert's journey north to the Darling Downs in 1844. Sydney to Gundemaine.

generally low, with Mangroves or reeds lining the edges of the water but the most striking feature along the banks of the Hunter, as we passed rapidly in the steamer, was the almost exclusive cultivation of Indian Maize, so much so that on many of the located parts, this appeared the only grain attended to'. He wrote that he arrived at Maitland the same morning, however he crossed out Maitland and replaced it with Morpeth. The Sydney Morning Herald (SMH) for 19 March (Anon., 1844b) scheduled the coastal steamer 'Rose' to arrive in Sydney and leave for '*Pattison* [=Patterson]' and Morpeth on 18 March.

In another footnote Gilbert added: '*Here I expected to find a horse in readiness for me to ride to Dartbrook* [the creek at Yarrundi, Stephen Coxen's property], *having by some unaccountable means supposed the distance I had to ride was about 12 miles* [19km], *but to my astonishment found it was 80* [128km] *and to add to my chagrin no horse had been left for me, I therefore took a place by the mail*'. In the notes there is no mention of Newcastle nor of an inn at this point as suggested by Webster (1980).

The '*mail*' left at noon, and passed through Lochinvar '*little resembling its namesake in Britain counting only about a dozen houses*', to Black Creek '*19 miles* [24 km] *from Maitland*'. This would be near the town of Branxton. Gilbert complained bitterly about the roads: '*occasionally on the road where the ground is soft you came to a road of heavy logs laid down, which very strongly reminds one of the log roads we read of in America, but this was not the worst part, for the major portion of the road is in very deep ruts, and the shaking I received in a very crazy vehicle, would have perhaps have had a beneficial effect had I been of a nervous temperament. However as it was I was tired and felt as if I had taken as much exercise as I could have done had I walked the distance!*'. The roads between Maitland and Black Creek were notorious for being extremely boggy (Wood, 1972).

The diary at this point is very descriptive, giving details of topography and listing various genera of plants, then comparing and contrasting these with those of '*the Swan River colony*'. The fact that he compared them with the Perth area and not Sydney, again suggests that he did not do much fieldwork near Sydney. This is emphasised by his comments that he: '*saw many familiar forms, although for a first time alive in a state of nature the several species of Trichoglossi* [=Lorikeets]'. This is a surprising comment given that Lorikeets were probably in some numbers in the Sydney area, while it is known that Gilbert had already sent Gould specimens of the Purple-crowned Lorikeet *Glossopsitta porphyrocephala*, Varied Lorikeet *Psitteuteles versicolor* and Red-collared Lorikeet *Trichoglossus rubritorquis* (Whittell, 1942a,b; also letter from Gilbert to Gould written in Port Essington 19 September 1840 in ML).

The mail crossed the Hunter River at a ford seven miles [11 km] further on, and crossed it again before reaching Patrick's Plains or Singleton, '*a scattered village on the left bank of the river*'. This route is no longer followed by the New England Highway as there are no crossings of the river between Newcastle and Singleton. After he arrived '*at the principal Inn*', Gilbert received a note explaining: '*the cause of not finding a horse left for me*', but did not give the cause in the diary. At this point he gives the footnotes previously mentioned and this is the source of Webster's error.

At four o'clock the following morning (20 March) he left for Muswellbrook and Yarrundi near Scone. His diary indicates he went by coach as far as Scone but it was not possible for him to have visited Cassilis, over 100km further west (contra Webster, 1980).

The entry notes: '*at* [blank] *miles we arrived at Dartbrook*'. This is the first mention that Gilbert was travelling in company with another person, as the coach would not have driven to Coxen's private property.

Most of the next two days' writing is illegible but he did not stay at Yarrundi long. In the pencilled section at the end of the fist volume of the diary is a list of numbers that correspond with the distances (in miles) that Gilbert travelled each day going north. The first measurement is '*80 From M*', the distance from Morpeth to Yarrundi. The next measurement is '*7*' and this appears to be the distance travelled on 21 March. His entry for 22 March begins with him, '*leaving Cresfield crossed over Walden's Range ... to the Pages* [River] *from where we crossed the Liverpool Range for Loders where we remained for the night*'. The property of "Cressfield" is some seven miles (11km) north of Scone and the New England Highway now runs past here over '*Walden's Range*' [= Warland's Range, see Wood, 1972] to the Pages River and the Liverpool Range (Royal Australian Survey Corps = RASC, 1970). This was, and still is, the major road north. "Loders" was the Loder brothers' property, near the present town of Quirindi (Wood, 1972; Goodwin et al., 1977).

Much as Chafer (1992) did, Albrecht & Albrecht (1992) inferred from Gould's instructions, that while at Yarrundi Gilbert was, *'undoubtedly collecting the specimens Gould had requested him to find'*. However, given the period of Gilbert's stay (one day) it is unlikely that Gilbert collected any of Gould's desired specimens at all.

The following day he travelled 42 miles (66km) over the Liverpool Plains and passed a bend of the *'Mokai'* [= Mooki] River known as Long Point. This bend is 7km north west of the town of Breeza (RASC, 1969). Gilbert noted that: *'from Long Point we moved on over the Plain to a station on the Mokai opposite Gunbunde'*. In the 1840s, Gunnedah Station had two homesteads, one to the north and the other to the south of the property. Gilbert was apparently referring to the southern homestead, then owned by members of the Johnston family (Longmuir, 1956). The northern homestead, then known as "The Woolshed", was located at a ford of the Namoi River, now the site of the town of Gunnedah. The route travelled by Gilbert over the latter part of the day was that of the main road as mapped by the surveyor H. Gorman some eight years later (Gorman, 1852). On 24 March he notes: [After]' *Four miles* [6km] *we crossed River Namoi and in about 8 miles* [13 km] *came again upon the river at Mr Wentworth's cattle station there being a good feed we brought up for the day'*. In the 1840s William Wentworth owned "Burburgate" some 10km northwest of Gunnedah (Campbell, 1931: Longmuir, 1956).

On 25 March they travelled a further 30 miles [48 km] down the Namoi through *'moderately timbered forest'*. Gilbert noted that: *'the principal incident of the day was the immense numbers of the migratory grasshoppers, the whole of the last 15 miles* [24 km] *we were fairly riding through them, ... the whole scene as far as the eye could reach is greatly resembling a fall of snow while in many parts of the road they have collected in such masses as fairly to discolour the ground*[,] *about half way in this distance of* [10?] *miles* [16 km] *we stopped a short time at a house*[,] *we were informed they had been passing three whole days excessively, in along the grassy land*[,] *as they proceed the grass is completely eaten off*[,] *there we observed in the road and on bare pieces of ground were employed in scraching* [sic] *little round holes, and so numerous were these that the ground appeared completely honeycombed. I apprehend they are employed depositing their eggs ... in some places they were so thick that trees two hundred yards* [200m] *distant can scarcely be seen through the cloud and when the wind is blowing they are constantly striking the face with their sharp claws till it becomes quite painful'*. That evening, *'we had a storm of thunder & lightning with a little rain'*. The following day, *'not a grasshopper was to be seen on the wing the rain of last night apparantly* [sic] *having checked their progress for a time'*. What Gilbert was describing was the breeding and movement of plague locusts *Chortoicetes terminifera* before a cold front (Woodruff, 1974, 1976).

On this day (26 March) they travelled a further 30 miles [48 km] to *'Gundamain'*. "Gundemaine" (for spelling see Campbell, 1931) was some 11km northwest of the present town of Narrabri on the north bank of the Namoi just below the mouth of Brigalow or Bohena Creek (McLean, 1847; Hunt, 1980). It was also visited by Gould in 1839 (Gould, 1865; McAllan, 1987) and is immediately upstream of the Parish of Gommel, Gould's Gummel-Gummel where he had observed Little Woodswallows *Artamus minor* breeding (Gould, 1865).

At this point Gilbert gives a list of birds observed on his journey *'thus far'*:

'Grallina Australis [*G. cyanoleuca*, Magpie-lark] - *Artamus albovittatus* [*A. cyanopterus*, Dusky Woodswallow] - *Oreoica gutturalis* [Crested Bellbird] - *Hirundo neoxena* [Welcome Swallow] - *Collocalia arborea* [*Hirundo nigricans*, Tree Martin] - *Collocalia ariel* [*H. ariel*, Fairy Martin] - *Haliastur sphenura* [*H. sphenurus*, Whistling Kite] - *Ichthyaetus leucogaster* [*Haliaeetus leucogaster*, White-bellied Sea Eagle] - *Pandion leucocephalus* [*P. haliaetus*, Osprey] - *Milvus isurus* [*Lophoictinia isura*, Square-tailed Kite] - *Falco frontatus* [*F. lunulatus*, Australian Hobby] - *Accipiter torquatus* [*A. cirrocephalus*, Collared Sparrowhawk] - *Aquila fucosa* [*A. audax*, Wedge-tailed Eagle] - *Corvus coronoides* [Australian Raven] [blank] - Halcyon sanctus [*Todirhamphus sanctus*, Sacred Kingfisher] - *Perdix australis* [*Coturnix ypsilophora*, Brown Quail] - *Anthus australis* [Australasian Pipit] - *Phaps chalcoptera* [Common Bronzewing] - *Columba spilonota* [*Geopelia cuneata*, Diamond Dove] - *Mycteria Australis* [*Ephippiorhynchus asiaticus*, Black-necked Stork] - *Wood Duck* [*Chenonetta jubata*] - Black Swan [*Cygnus atratus*] - *Rhipidura Motacilloides* [*R. leucophrys*, Willie Wagtail] - *Seisura volitans* [*Myiagra inquieta*, Restless Flycatcher] - *Ardea Novae-Hollandiae* [*A. novaehollandiae*, White-

faced Heron] - *Ardea pacifica* [White-necked Heron] - *AEgiatilis nigrifrons* [*Elseyornis melanops*, Black-fronted Dotterel] - *Otis Australis* [*Ardeotis australis*, Australian Bustard] - *Amadina castanotis* [*Taeniopygia guttata*, Zebra Finch] - *Fulica australis* [*F. atra*, Coot] - *Petroica bicolor* [*Melanodryas cucullata*, Hooded Robin] - *Melopsittacus undulatus* [Budgerygah] - *Graucalus melanotis* [*Coracina novaehollandiae*, Black-faced Cuckoo-shrike]. *The nest and* [eggs of?] *Peristeri* [*Phaps histrionica*, Flock Bronzewing]'.

Some of these birds, such as the Black-necked Stork, Osprey and the White-bellied Sea Eagle were probably seen on the lower Hunter River, though most could have been seen further inland (Morris et al., 1981). Gilbert's record of Square-tailed Kite, however is open to question given his difficulty in identifying this species during the Port Essington Expedition the following year (Debus et al., 1993).

The order of species in the above list is similar to the first part of a list that Gilbert sent in a letter to Gould from the Darling Downs dated 8 June 1844 (Fisher, 1985). This suggests that Gilbert was either using the list in the diary to jog his memory, or that a number of species in the letter written on the Darling Downs were not seen on the Downs at all.

Gundemaine was obviously an intended stopping place as they did not leave until 3 April. While here Gilbert collected and observed a number of animals. On 30 March he recorded in his pencilled collection notes: '*A nest of A.*[*madina*] *modesta* [*Neochmia modesta*, Plum-headed Finch]. *The nest formed of dry wiry grass, but not* [blank] *so long a spout as the Swan River species, lined with feathers, the nest placed in a thick bush on the banks of the river, and so near the ground the bottom of the nest was almost touching, contained five eggs, another nest I saw yesterday had two young and two eggs, this was built in a small bush about two feet from the ground. This is the second breeding of these birds, attributable in a great measure from the long continuance of summer weather. Gundamain, River Namoi*'. One of these nests was obviously collected, as Gould mentioned Gilbert providing him one (Gould, 1865). He also noted a '*Lepidostias Long Mouth'd Fish*', which he presumably collected, though its identity at present remains unknown (T. Trnski, pers. comm.). The following day he recorded: '*eggs of C*[*olumba*] *spilonota* [*Geopelia cuneata*, Diamond Dove] *taken 1 April 1844 banks of the Namoi, small loose nest made of sticks*'. While he also noted: '*Teen=burn Aborig. of Namoi Podiceps* — [= Grebe sp.]'.

On 3 April they travelled to '*Goolathra at a distance of 11 miles*' [18km]. "Galathra" was a property acquired by William Wentworth some time before 1848 (Campbell, 1931; Fig. 2) and was on Galathera Creek to the north of Gundemaine (RASC, 1988). Gilbert collected a Letter-winged Kite *Elanus scriptus* at this locality and gave it the Aboriginal name of 'Til=yeer=gar=bul' (pencilled collection notes).

During the day Gilbert: '*saw* Peristera histrionica [*Phaps histrionica*, Flock Bronzewing]. *the species I obtained the eggs of a few days ago, they were very abundant, breed on the ground lay two white eggs*'. Gilbert's sightings of this species near Gundemaine and collection of eggs seem to have gone largely unnoticed in the literature, for example Frith (1982) noted: '*Gould encountered large groups on the Namoi but apparently they have not been seen again in the district*'.

Gould himself never mentioned receiving the eggs that Gilbert collected and in his Handbook account only gave the details of eggs collected by Sturt north of the Barrier Range (Gould, 1865). This is surprising as Gould had looked at the diaries when he referred to Gilbert's records of Flock Bronzewings from '*the plains in latitude 19°S*', that is, on the Port Essington Expedition. Moreover Gilbert had also told Gould in his letter of 8 June 1844 that he had collected the eggs. This letter did reach England as Gould himself acknowledged this (Fisher, 1985; draft of letter from Gould to Gilbert dated 20 December 1844 in National Library of Australia, Canberra, hereafter NLA). As noted by Chisholm (1944) Gould was erratic with his reference to Gilbert's diary, occasionally quoting minor incidents in great detail while ignoring others altogether.

On 4 April 1844 Gilbert's party travelled, '*10 miles* [16 km] *in continuance of Peristera Creek*', presumably referring to the creek now known as Ten Mile Creek. Gilbert noted: '*during the morning immense flocks of* Peristera histrionica *started found two of them breeding*[,] *2 eggs on the bare ground, 4 miles* [6km] *to a second creek like all the former running across the plain, from this 6 miles* [10km] *to a small creek tracing a branch of the Waterloo Creek where we stopped the night at a Sheep Station*'. The second creek passed would have been the creek now called Boggy Creek while the creek at which they stopped would have been Gehan Creek, the creek to the south of Millie Creek. In 1844 Millie Creek

was known as Waterloo Creek, presumably after the property of the same name which is on this creek near the Newell Highway (Gardiner, 1844; RASC, 1982). Gilbert also recorded that he '*saw the Artamus cinereus* [Black-faced Woodswallow]'

On 5 April, Gilbert, '*Travelled over plains*[,] *at one mile* [1.6km] *crossed a creek 4 miles* [6km] *on crossed a second*'. He records the presence of grasshoppers again while he also noted: '*shot a Bustard* [Australian Bustard, *Ardeotis australis*] ... *Peristera very abundant. Peregrine Falcon* [*Falco peregrinus*] *and Milvus* [= Kite sp.] *in great numbers the birds feeding freely upon grasshoppers. A further distance of 10 miles* [16km] *brought us to Bombell*[,] *a Station on Myall Creek*'. From the distances quoted it appears the first creek crossed in the day was Waterloo Creek, the second being Little Bumble Creek and Gilbert's '*Myall Creek*' was the creek now known as Gurley Creek (RASC, 1982, 1987). At the time there was a property on Gurley Creek known as "Bumble" (Galloway, 1854). Gilbert's specimen collection notes also record him collecting a '*Mus*' at Myall Creek which is confirmed in the diary.

On 6 April they, '*remained stationary all day. In a ramble up and down the creek I saw many birds for the first time in a state of nature among the most remarkable Chlamydera maculata* [Spotted Bowerbird] *and the Crested Bronzewing* [*Ocyphaps lophotes*, Crested Pigeon]'.

On 7 April they travelled eight miles [13km] to '*Bowman's Creek*'. This was the name of the creek that passed through George Bowman's property, "Terry Hie Hie" and is now known as Tycannah Creek (Wiedemann, 1981; Division of National Mapping, 1975; RASC, 1987). This distance is the same as that from Gurley Creek to Tycannah Creek at the town of Tycannah when coming from the south west. The main road at the time veered to the west from Gundemaine north to Tycannah while the present Newell Highway goes straight north from Narrabri (Gardiner, 1844; McLean, 1847; RASC, 1987). While at Tycannah Creek, Gilbert noted: '*water in small pools in which I caught a fish very like the Common Roach*'. This was no doubt a species of fish he referred to in his pencilled descriptions as '*Peer=nga*'.

They then travelled, '*7 miles* [11km] *further on in distance* [several illegible words] *Halls Station on the Big River* [=Gwydir River], *and then on*[,] *on to the plains ... Here I saw the Graucalus phasianellus* [*Pteropodocys maxima*, Ground Cuckoo-shrike] *feeding on the ground. Park like open country* [.] *Bivouaced on* [blank] *creek running parallel with the river*'. The distance given by Gilbert does not actually reach the Gwydir River but falls some three miles (5km) short at a creek now known as Halls Creek south of the present town of Moree. From his pencilled description referring to the collection of a fish known as '*Pob=be*' on '*Mr Hall's* [station]... *Big River*', it can be seen that Gilbert was at the property of George Hall who owned "Webollabolla" east of Moree which is itself two miles [3km] south of the Gwydir (McLean, 1847; Campbell, 1931). There was probably no settlement at Moree at the time as James Cox obtained his licence for this station some four months later (Jervis, 1963). This disparity in distances is addressed by Gilbert when he noted in his list of mileages at the end of the volume an unaccounted five miles [8km], the distance from Halls Creek to the Gwydir River via Webollabolla.

The following day they were again stationary. His diary refers to, '*a new fish*', undoubtedly the '*Pob=be*' recorded as coming from, '*Mr Hall's*' station. Gilbert gave counts of the spines of the fish that, by themselves, do not identify the species (S. Reader & T. Trnski, Australian Museum, pers. comm.). A description of the fish is also partly legible and it reads: '*colour of the upper part light* [several illegible words] *body and had bright red spots*'. The '*Pob=be*' is probably the fish now known as the Spangled Perch *Leiopotherapon unicolor*. Described as *Therapon unicolor* by Günther in 1859, its type series in the BMNH was collected at '*Gwydir River*' and '*Head of Mosquito Creek, near Darling Downs*' and appears to have been collected by Gilbert (Fisher, 1992). Furthermore this species does indeed have bright red spots on its body.

On 9 April they went '*8 miles* [13km] *up river to Moki=branch* [=Mehi Branch]'. Gilbert actually noted the reverse of the present names. At present Moree is considered on the Mehi Branch of the Gwydir with the main branch flowing to the north- west. At the point where they stopped for the night Gilbert noted: '*Here met with the greatest encampment of Natives we have hitherto seen and at night every one* [spending some?] *considerable time with their noisy corrobori, or what might be termed vociferous screaming*'. On 10 April they were again stationary and Gilbert noted: '*Natives all day*'. On the 11th they travelled ten miles [16km] up river to '*Eaton Station 3 further to Eales*'. According to

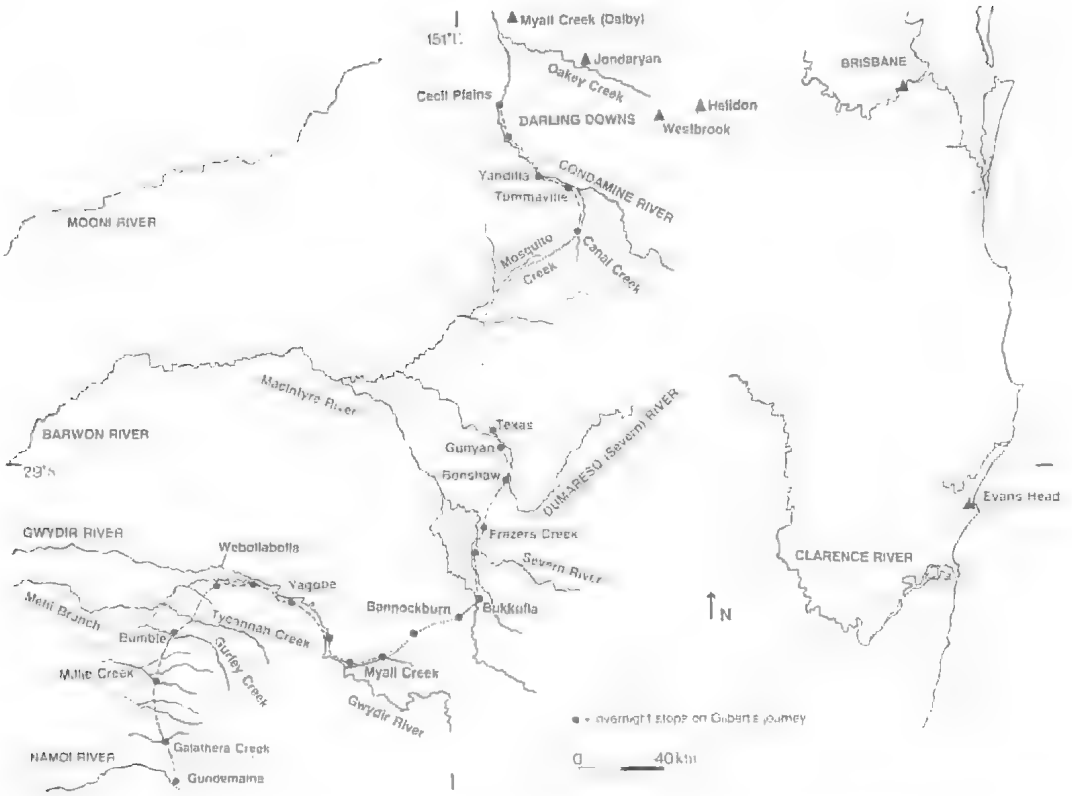

FIG. 2. Gilbert's journey north to the Darling Downs in 1844. Gundemaine to the Darling Downs.

Campbell (1931) Daniel Eaton held "Binnigy" [now = Biniguy] while John Eales was the licensee of "Yagobi" [= Yagobe] (Barker, 1987).

On 12 April they travelled 12 miles [19km] cutting off some bends of the river. They stopped for two hours and then went a further eight miles [11km] finishing the day at the station owned by *'Gally'*. This was George Gally, who lived at "Gingeroi" (Barker, 1987). However Gilbert, *'did not meet with the usual hospitality at Gally and went to bed on a midshipmans supper'*. The area covered in this last stage was, according to Gilbert, dominated by an ironbark with a very dark trunk and branches and contrasting glaucous leaves, possibly *Eucalyptus caleyi*. From this point on large parts of the pencilled diary are illegible, and in many instances little more than Gilbert's movements can be discerned.

They travelled for 12 miles [19km] on 13 April and the following day a further nine miles [14km], *'leaving the Big River'*. It would appear they were travelling up Myall Creek which Gardiner (1844) again noted as a major route. The account for 15 April is totally illegible, while they were stationary on 16 April. On 17 April they travelled 23 miles [36km] and reached a Mr Waterford's station. In 1844 William Waterford owned "Bannockburn" some 19km north west of Inverell (Wiedemann, 1981). This would suggest that on 15 April they passed near the locality of the present town of Delungra. On 18 April they reached *'Wyndham's Station on the MacIntyre'*, which was "Bukkulla", owned by George Wyndham. The entry for 19 April is largely illegible and the following day they were *'stationary all day to rest the cattle, see no Natives at all now,'*. This is a suggestion that they were moving stock and that Gilbert may have been concerned about Aborigines, though their intent was not indicated.

On 21 April they moved, *'9 miles* [14km] *down the Fraser* [= Frazers Creek] *to Blaxland's Station'*. Gregory Blaxland owned "Frazer's Creek" at this time, some 11km north of the

present town of Ashford (Wiedemann, 1981) Thus on the 19th they had moved to three km south of Ashford. On 22 April they travelled 14 miles [22km] to *'Hatherington's Station'*, this was "Bonshaw" which was owned by the Reverend Irving Heatherington at the present town of the same name. Bonshaw is on the Dumaresq River, now the border between New South Wales and Queensland.

On the 23rd they moved, *'12 miles* [19km] *down the Severn over a hilly country to Cox's Station, here we have to wait for the rest following us with sheep and a cart with Provisions so that we can travel farther'*. William Cox held "Gunyan" station at about this time, to the south-east of the present town of Texas (Wiedemann, 1981). Gilbert's collecting notes record that he collected a *'small Antechinus'* on 23 April and gave it the Aboriginal name of *'Ne=moo=ga'*. He also collected a *'Circus'* (harrier) species, *'on the Severn April 23rd 1844'*. He had actually travelled along the Severn River as it is now known, two days before when passing the location of Ashford. This was a consistent mistake in Gilbert's notes and corresponds with occasional use of the name Severn for the Dumaresq River (Hamilton, 1960; Division of National Mapping, 1976).

From here on the diary is particularly difficult to read. In the period from 24 - 28 April Gilbert comments at length about fighting between the Aboriginals and Europeans in what is now northern New South Wales and southern Queensland. He began by referring to the large number of Aborigines that had been killed in *'the New England district ... one instance I heard of a party going out with the* [expressed?] *purpose of hunting Natives*. He also noted that one group had *indiscriminately slaughtered their women & children'*. In short, Gilbert described it as, *'cruel warfare'*.

The fighting had not been all one way, for Gilbert mentioned problems that the Europeans had had with Aborigines in the Barwon and Mooni river areas. Jervis (1962) points out that a number of the stations on the Mooni River were abandoned during 1843 because of Aboriginal attacks, while there were numerous incidents on the Barwon River where both Blacks and Whites were killed. So great had been the animosity that according to Gilbert, the Europeans, *'came to the determination of exterminating the whole of the Natives on the Mooney'*, and that this had come, *'into effect within the last 18 months'*.

He also recounted a specific incident where the Aborigines attacked a group of Europeans: *'Several of the modes of attack were certainly very daring, at one station, they came down a hill at the back, several hundred en masse, well armed with spears and boomerangs, all the fighting men surrounded the hut and stockyard and then cut off all chances of the people obtaining their horses, they then chose from a number of cattle in the yard the fattest which was* [at once?] *deliberately speared'*. The fragments that can be read of the remainder of this incident include the burning of fences and, *'the people who were in the hut ... were obliged to attempt to save themselves, some only succeeding in this, the hut was then burnt down'*.

Gilbert suspected that *'the lower classes of Society'* were:

'in league with the Barwon Blacks for many of their plans of attack have been as new and different from the Aborigines usual plans such as driving away a herd of cattle and making temporary yards each night, and after getting them to an uninhabited part of the country, regularly herding them and killing a beast as they required a fresh supply of food, this I understand has been done, which is far too systematic a proceeding for any savages to follow out without some tutoring from whites although it is not proved that any of our own countrymen are really guilty of such a crime still it is well known there are hundreds of men quite capable of such things.

Generally speaking the working classes, that is to say the labourers of New South Wales entertain a thorough dislike to the Natives being on an establishment, considering that where a native is employed, it is to the exclusion of one of their own class, this jealousy caused them to show them dislike in various ways and it is through outrages upon the Blacks by this class of persons, that account of the outbursts may be attributed'.

Gilbert's opinion of the cause for enmity between the Aborigines and Europeans ignored the fact that the Europeans had invaded the Aborigines land less than ten years before (French, 1989). Yet the tensions would hardly have eased as a result of the character of the people who were likely to be the shepherds and stockmen of the time. In 1843, James Demarr described his fellow shepherds on the Darling Downs as *'the vilest scoundrels and ruffians, who thought no more of shooting a stray blackfellow than they would a mad dog'* (French, 1989).

It has been suggested that Gilbert greatly feared Aborigines (Webster, 1980), though any prudent European would at that time. As noted above

there had been a number of attacks on Europeans on the Barwon, MacIntyre and Darling Downs areas at around this time (Jervis, 1962; Wiedemann, 1981; French, 1989). Indeed in early 1843 Charles Coxen, Gould's brother-in-law, was attacked by Aborigines near the present city of Toowoomba while one of his employees was also attacked on his property "Jondaryan" (French, 1989; Anon, 1843).

While at the '*Severn*' Gilbert recorded in his collecting notes '*Moo=ling=ga Spotted-throated Finch. Irides reddish yellow*'. The only finch with spots on the throat and reddish yellow eyes that could have been in the area is the Star Finch *Neochmia ruficauda*, a species now extremely rare in eastern Australia. Gilbert then collected, '*Amadina lathami* [*Stagonopleura guttata*, Diamond Firetail]', again giving the bare-part colours, the Aboriginal name '*Ngoo=re moo=ga ra*', and noting that it was '*Killed on the Severn. April 24*'. He also recorded that: '*On the Severn I saw a pair of the banded Red-knee* [presumably the Red-kneed Dotterel, *Erythrogonys cinctus*], *Ardea pacifica* [White-necked Heron]'.

On 29 April Gilbert noted: '*The party with the sheep came up to day's preparation for tomorrows stage*'. The following day, 30 April, they had barely started for the day, '*when about 3 miles* [5km] *the wheel would not turn ... being Mair's patent axletie it was too complicated too get off very easily and night coming on we gave it up as hopeless*'. That day and the next night it rained and on the following day they were again stationary while they took the wheel off.

On 2 May they started again but, '*moved about mile & half* [2km] *to McDougalls Station where we pitched our tents. the day still raining*'. John McDougall occupied "Collebelaa" in 1840 on the site of the present town of Texas (Wiedemann, 1981). As this was only in the next valley from Cox's Station it appears that the period from 24 to 29 April was spent at the latter locality.

The following week Gilbert regularly commented on the boggy roads, presumably caused by the rain from 30 April to 2 May. On 7 May for example, Gilbert noted that with, '*each step sinking up to the knees, added to this we were constantly breaking our better set of harness*'. On 8 May Gilbert noted: '*here some blackfellows came up the first we have seen here*'.

Much of the remainder of the pencilled notes are illegible though on 9 and 10 May he was at Mosquito Creek where he presumably collected further specimens of the Spangled Perch. On 13 May he noted that they '*were following the Canal Creek we arrived at Pitt & Bonaparts*', no doubt the same Pitt that Leichhardt had visited the year before (Aurousseau, 1968). In the next few days the diary mentions reaching the Condamine River. This suggests that the route followed since leaving the McDougall's property was the stock route pioneered by Patrick Leslie in 1840 (see French, 1989).

The brief final entries for the journey can be read in full. They are as follows:

'Fri 17 [May] *To Gores New Parrot*
Sat 18 [May] *From Gores head Station to Sheep Station 16 Miles* [26km]
Sun 19 [May] To Russells & Brookes 9 Miles [14km]
Mon 20 [May] *To Old Station 5 Miles* [8km]
Tues 21 [May] *To Coxens 10 Miles* [16 km]'.

St George and Ralph Gore's Station was "Yandilla" on the Condamine River (French, 1989; RASC, 1978). The *'New Parrot'* concerned was the Paradise Parrot *Psephotus pulcherrimus*. This date corresponds with that given on the tag of specimen D789a in the National Museums and Galleries on Merseyside [hereafter LIVCM], Liverpool, United Kingdom, considered a paratype by Fisher (1986). This specimen has the original label written in Gilbert's hand, *'Male. May 17 1844, Condamine River, Darling Downs, New South Wales'*, and reverse, *'Irides Dark Brown'*. It is the first specimen of this species that Gilbert collected, though his comments in a letter to Gould indicate that it was not the only specimen of the Paradise Parrot that he collected (Fisher, 1985, 1986).

Given that the party was travelling between five and sixteen miles [8 and 26km] each day for the last few days of the journey to Coxen's station it would appear that the specimen was collected between "Yandilla" and the previous station upstream on the Condamine River, "Tummaville", owned by Dr John Rolland and Domville Taylor.

As to the remainder of the journey, Henry Stuart Russell and Gerald Brooks occupied "Cecil Plains" further downstream from Yandilla in 1841 and it was this station Gilbert reached on 19 May. Gilbert's distances for the last two days appear to be incorrect. The distance from "Cecil Plains" to Charles Coxen's "Jondaryan" is 25 miles [40km] and not 15 miles, while it was even further to the other Coxen property, "Myall Creek". Although Gould's nephew, Henry W. Coxen, had occupied "Myall Creek" in 1842, it was then considered to be the northern part of Jondaryan. The first house on "Myall Creek" was

not built until 1846 (French, 1989; Challinor, 1919; Russell, 1888).

The question remains as to the identity of the people who were travelling with Gilbert. He cannot have travelled with either Stephen or Charles Coxen as they were both in Sydney signing insolvency papers at the time Gilbert was at the Dumaresq River (C. Coxen, 1844; S. Coxen, 1844). Some clues to his companions are found in a newspaper article which concerns the Coxen family (Challinor, 1919). This article is based on a series of notes dictated by Henry W. Coxen to his son H.C. Coxen on 14 September 1888 (letter and notes now in ML).

Challinor noted that in 1842 H.W. Coxen took *'two drays, 300 cattle, three men and a black boy'* to the Darling Downs. One of the men was a Lieutenant Irving, but the names of the others were not given.

The article further recounts: *'On the way and between the Severn River and Canal Creek one of the drays broke down - a serious incident in those far off days. Irving took on the other dray, the cattle, and the broken axle which he got repaired by Arthur Hodgson's blacksmith at Eton Vale* [south-west of Toowoomba]. *A month elapsed before the mended axle was returned to Coxen, and during the interval among other difficulties encountered were attacks by wild aboriginals and a very severe illness. Here it was that S. and H. Russell, Brookes and Glover passed on their way North'.*

In the original notes there is the further information that in around 1843 or 1844 H.W. Coxen, *'undertook to overland 3000 sheep from Homebush* [in Sydney] *to the Downs via Wiseman's Ferry and the Wallambi Mountains* [=Wollombi] *over which progressed one mile a day the journey occupied six months camping out all the time'*. The route that H.W. Coxen described through to the Hunter Valley is the Great North Road which went from Wisemans Ferry to Wollombi and then to Singleton.

There are a number of errors in both the newspaper and manuscript versions, for example the sequence of events relating to the Leichhardt expedition are incorrect. Thus it is possible that parts of H.W. Coxen's account may be confused, with the axle breaking on his second delivery of stock and not the first.

Gilbert appears to have been involved with the overlanding of stock, both cattle and sheep, although apparently not before reaching Gundemaine. It is not surprising that H.W. Coxen had Gundemaine as a major stop, for apart from being about half way to the Darling Downs he had worked on the station in either 1841 or 1842 (Challinor, 1919). Indeed, as noted before, his uncle, John Gould, had also visited this station.

Before reaching this locality Gilbert was regularly travelling 48km each day. After leaving Gundemaine, where he stayed at least six days, the furthest travelled in a day was about 36km, though it was usually less than 20km. Even so, these distances are surprisingly long for stock to travel in a day, which was usually about 14km per day for cattle and 10km per day for sheep (see for example Crawford, 1993: 177). We know from Gilbert's comment on 20 April that he was travelling with a party with cattle. From the number of stationary days, five days in the three weeks between Gundemaine and Cox's station, it appears the strategy was to drive the cattle hard for a number of days and then let them rest for a day. The longer stop at Cox's station allowed for the party with the sheep to arrive before they travelled east over the sparsely occupied country to the Condamine River. This strategy may have been used to reduce contact with Aborigines and, fortuitously, allowed Gilbert time to collect specimens.

GILBERT ON THE DARLING DOWNS: HIS COLLECTIONS

Again, virtually nothing is known of Gilbert's activities between 21 May and 18 September 1844 when the Port Essington Expedition left John Campbell's property "Westbrook". He wrote a number of letters. Three survive, one each to Gould, Bennett and Strange on 8 June, 10 September and 16 September respectively (reprinted in Fisher, 1985; Whitley, 1938; Whittell, 1947).

The first letter refers to the collection of the type specimen of the Paradise Parrot and a list of species seen, but as noted, it is possible a number of these may not have been seen in the area at all. The other two letters reveal that Gilbert did not do much travelling or collecting. In his letter to Bennett he wrote:

'During the short time I have been in this district I have been able to do but little, the weather has been so unpropitious, the whole time, as to prevent me moving about the country; I have a new Parrakeet nearly allied to Platycercus haematogaster [*Psephotus haematogaster*, Blue Bonnet], *but a much more beautiful bird, and I have several new species of Mus, and four new species of Grays genus Antechinus, and many*

other novelties particularly fresh water shells & Fish. ... I have collected many interesting seeds for Mrs. B. which I shall send down with my collection to Mr. Strange to repack, at the same time giving him directions to take out a package of the most interesting'.

In his letter to Strange he gave the further information:

'I have packed up a small collection for Mr. Gould, and you would oblige me very much by sending them off by the first, and post the enclosed letter by the same vessel, the reason of my sending so small a collection is that I have determined on joining Dr. Leichhardt's overland expedition; would you not like to go? ...'

'I only received your letter of the 17th July a few days ago, and of course have not yet received my boxes you have been kind enough to send, and the letter you sent from Mr. Lefroy I cannot hear anything of, although repeated enquiries have been made for me at the Post Office. ... You can unpack the box and look at the specimens, and if not giving you too much trouble, perhaps you will get a tin top soldered on to make it more secure; the only thing new in the collection is the parrot I mentioned to you in a former letter, and the smaller Quadrupeds, which I think are nearly all new. I am sorry I have not been able to get you a few beetles, but the weather has been so cold and cheerless that scarcely any insects are to be found'.

Gilbert wrote that he had not moved far in the four months he spent in the area. In the pencilled notes immediately before the Port Essington Expedition diary begins is the annotation: *'Wallaby killed at Pearces about the size of manicatus [Macropus irma* Western Brush Wallaby] *general* [blank blank] *having a white stripe on the cheek, red patch* [illegible to end]'. This suggests that he may have at some stage visited J.C. Pearce who lived at Helidon east of Toowoomba (French, 1989).

The identity of the Wallaby remains a mystery, though Gould (1849) noted that Gilbert found that the Bridled Nailtail Wallaby, *Onychogalea frenata*, *'was common in the thick patches of scrub which are dispersed over all parts of the Darling Downs'*. There are two Gilbert specimens of this species in the collections of the British Musuem (BMNH 53.10.22.28, BMNH 53.10.22.29). The first was *'No 9'* collected at *'Oakey Creek, Darling Downs'* with no other information, while the second was collected on *'Aug. 19 1844'* with the locality given as *'the brushes of Oakey Creek* (C.T. Fisher, pers. comm.)'.

It is not known whether Gould received any specimens from Gilbert beyond the *'small collection'* that was sent via Strange. From these specimens, Gould named two birds, four mice and one dasyurid (Gould, 1845a,b, 1846a, 1858a).

Gilbert sent a number of mice in his *'small collection'*. The pencilled collection notes refer to a number of possible *'Mus'* species and other taxa that were collected while he was near the Namoi and Gwydir Rivers. The notes in part read:

'Til=yeer=gar=bul Elanus scripta.
Irides bright reddish brown, bill black.
Legs & feet yellowish white, claws black.
killed at Goolathra April 4 1844.
Mus — Boo=i=bi Aborig. of Myall Creek.
[crossed out name] Aborig. of Namoi
Inhabits the fissures on the open plains north of Gundamain, first specimen caught 5 April 1844.
Small Mus - Dil=pea Aborig. Myall Creek
Seen=be Freshwater Muscle
Peer=nga Small Freshwater Roach caught in small pools of Bowman's Creek.
Fish caught in a creek near Mr Hall's [blank blank] *Big River.*
Pob=be of the Natives of the Big River [count of spines, plus partly legible description]
Small Mouse like House Mouse. Tar=li of the Natives, very abundant on the plains
Peer=nga [count of spines, plus description]'.

This sequence of entries creates a number of problems. First the account is not strictly in chronological order as the *'Peer=nga'* description was written after Gilbert had arrived at *'the Big River* [=Gwydir River]', though it was collected at Bowman's Creek further south the day before the collection of the *'Pob=be'*. Another problem is the use of the locality *'Myall Creek'*. From the chronological sequence the *'Myall Creek'* concerned is the first that Gilbert crossed which is now known as Gurley Creek. He later passed a Myall Creek near Delungra, another creek of the same name near Bonshaw and finally the Coxen's unoccupied northerly station had the same name. However it must be assumed that all the specimens with the locality so named were from Gurley Creek.

One of the first *'Mus'* supposedly collected by Gilbert from this period was the New Holland Mouse, *Pseudomys novaehollandiae*. In 1856 Gould noted, *'Mus Novae - Hollandiae ... I have now before me additional specimens ... collected*

on the banks of the Gwydir, where they were procured by Mr. Gilbert. ... Mr. Gilbert states that, when travelling among the high grass in the neighbourhood of the Gwydir, he constantly started it from out of the fissures in the dry ground'. However this species is now unknown from inland Australia, and rather than being found in grassland it tends to be found in regenerating heath (Strahan, 1983). Records of this species from the Pilliga Scrub were later found to be of a distinct species *P. pilligaensis* Fox & Briscoe, 1980, the Pilliga Mouse (Watts & Aslin, 1981; Strahan, 1983). So either Gould misidentified the specimen, or misread Gilbert's notes or Gilbert's original label was placed on the wrong specimen.

Several possibilities arise from these alternatives. The New Holland Mouse referred to by Gould may have been a Plains Rat, *Pseudomys australis*. In 1853, under *Hapalotis murinus*, a synonym of the Plains Rat, Gould noted: *'The original specimen from which my description was taken was procured by Mr. Gilbert on the plains bordering the rivers Namoi and Gwydyr* [sic], *where the natives informed him it was very abundant'*. There is a specimen in the BMNH, number 53.10.22.4, apparently collected by Gilbert on the *'Plains near the Namoi River'*, with the tag *'No. 2.'* (J.A. Mahoney's unpublished catalogue of Australian Muridae in the BMNH, in the Australian Museum). The habits suggested by Gould for the New Holland Mouse actually match the habits known for the Plains Rat and also correspond with Gilbert's comments for the *'Mus — Boo=i=bi'* he collected on 5 April at *'Myall Creek* [=Gurley Creek]'.

The BMNH also holds a specimen (BMNH 56.10.28.4) of the now extinct *Pseudomys gouldii*, Gould's Mouse. This is labelled *'No. 4. Gwyder River Plains, New South Wales'* in Gilbert's hand. Gould's account for this species in the 'Mammals of Australia' makes no mention of any collection of this species from the Gwydir River by Gilbert (Gould, 1855). The size range of the Gould's Mouse matches Gilbert's reference to the collection of a *'Small Mouse like House Mouse. Tar=li of the Natives'*, and is also similar in size to the New Holland Mouse. Thus Gould's Mouse could also be the species with which Gould confused the New Holland Mouse.

Gilbert's *'Tar=li of the Natives'*, also recalls another taxa described by Gould. In 1857 Gould wrote of *Mus lineolatus* Gould, 1845 [another synonym of *Pseudomys australis*, Plains Rat]: *'This species of Mus was discovered by Mr. Gilbert on the Darling Downs, where it appears to be abundant. ... Mr. Gilbert states that it is called the Yar-lie by the Natives of the Darling Downs; that it is common in all the open parts of the grassy plains, and that he believes it is confined to the interior of the country..'*

Gilbert's *'T'* in the pencilled notes here looks like a *'Y'* and so is undoubtedly referring to the same animal. Gould's error suggests that he was looking at this section of Gilbert's diaries when writing his account in 1857. However the animal referred to by Gould may not correspond with Gilbert's *'Tar=li'*, as the Plains Rat is much larger than a House Mouse, *Mus domesticus*. The lectotype of *Mus lineolatus* [= *P. australis lineolatus*], BMNH 58.11.24.4, is labelled *'July 1844'* and *'No. 6'*, as is a paralectotype in the LIVCM (Fisher, 1984; Mahoney Catalogue). There are another two undated specimens from the Darling Downs in these Museums which are considered paralectotypes. Gilbert only visited the Darling Downs in May to September 1844, so the Plains Rat may have been collected at both the Darling Downs and the Namoi-Gwydir area, and Gould incorrectly referred to the Darling Downs Aborigines as the source of the name *'Tar=li'*. The Plains Rat has never again been reported alive from New South Wales nor south east Queensland. It is now rarely reported elsewhere and could be close to extinction in the wild (Breed & Head, 1991).

From the above it can be seen that Gould may have made several errors with information concerning these mice: 1, he used Gilbert's notes on the habits of the Plains Rat (as *Hapalotis murinus*) for the New Holland Mouse; 2, he may have referred to Gilbert's specimens of Gould's Mouse *Pseudomys gouldii*, under his account of the New Holland Mouse; 3, he incorrectly referred the name *'Tar=li'* as used by the Aborigines of the Namoi-Gwydir area to the Aborigines of the Darling Downs; and, 4, *'Tar=li'* may have actually referred to Gould's Mouse and not the Plains Rat (as *Mus lineolatus*).

The third species of mouse described by Gould from the collections sent from the Darling Downs was *Mus gracilicaudatus* [= *Pseudomys gracilicaudatus*, Eastern Chestnut Mouse] which was collected at *'Oakley Creek* '[= Oakey Creek] (Gould, 1845b). This is the creek on which Jondaryan is situated. Gould later considered this name a junior synonym of his *Mus lineolatus*, and so did not discuss it further, but it is now thought to be a separate species (Gould, 1863; Mahoney & Posamentier, 1975; Watts & Aslin, 1981). A

single specimen, BMNH 58.11.24.3, considered the holotype, was collected from *'Oakey Creek - Darling Downs'* and labelled by Gilbert as *'No. 15'* (Mahoney catalogue; C.T. Fisher, pers. comm.).

The fourth species of *'Mus'* was described by Gould much later in 1858 as *Mus sordidus* [= *Rattus sordidus*, Canefield Rat]. There are four specimens of this form that may have been collected by Gilbert. One LIVCM D407, has the label *'Darling Downs'* in Gould's hand (C.T. Fisher, pers. comm.). The other three, including the lectotype and paralectotype designated by Thomas in 1921 are in the BMNH and are all labelled *'No. 7'*. One of these, the paralectotype, BMNH 58.11.24.5, has an original Gilbert label "No. 7. July 1844. Open Plains, Darling Downs, New South Wales". The Canefield Rat was said by Gould (1858b) to be the:

'Dil=pea of the Aborigines of New South Wales ... Very fine examples of this robust and compact Rat were procured by the late Mr. Gilbert on the Darling Downs in New South Wales. At present these specimens are in my own collection, but when this work is completed, they will form part of the rich stores of the British Museum. Mr. Gilbert states that it is common on the plains, and is occasionally found on the banks of the creeks, and adds, that it mainly feeds on the roots of stunted shrubs'.

From Gilbert's pencilled notes it can be seen that the mouse that he referred to as *'Dil=pea'* was actually a *'Small Mus'* which he collected at Gurley Creek. Far from being small, the Canefield Rat is one of the largest of the native rats in the genus *Rattus* (Watts & Aslin, 1981; Strahan, 1983), and indeed Gould considered it *'robust'*. In this instance there may have been an error with labelling and Gilbert's label is now on the wrong specimen.

The Canefield Rat has never been recorded again from south east Queensland, nor has it been recorded from inland New South Wales, though it has been recorded from coastal north east New South Wales. Similarly Watts & Aslin (1981) thought that Gilbert's habitat and feeding observations did not correspond with information known for this species.

The problem thus arises as to where these specimens of the Canefield Rat and the New Holland Mice were collected. One possibility is that they were collected closer to the coast, perhaps near Helidon. However Gilbert made no mention of specimens collected there other than his wallaby, while it is not even certain that he went there. In any case the New Holland Mouse has not been recorded from Queensland (Watts & Aslin, 1981; Strahan, 1983). The most likely explanation is that the specimens of the Canefield Rat were not collected by Gilbert at all, but by another collector, Frederick Strange.

During 1844 Frederick Strange travelled widely along the north coast of New South Wales acquiring many specimens. In mid-April he collected specimens on the lower Hunter (Anon, 1844c). Later in August, Strange visited Port Macquarie and returned to Sydney on the the coastal steamer, the *Maitland* on 22 August (Anon, 1844d). On 6 September [written as 6 August in error] *'1 box specimens natural history'* was shipped in his name on the barque 'Haidee' bound for London (Anon, 1844f), presumably those he had just collected.

H.M. Whittell's unpublished material concerning Strange (now held by the Royal Australasian Ornithologists Union Library, Melbourne) notes that Strange recorded collecting a Sooty Owl *Tyto tenebricosa* on *'4 Sept. 1845'* and a Plumed Frogmouth *Podargus ocellatus plumiferus* on *'14 Sept. 1845'*, on the Clarence River. As Gould described the Sooty Owl in July 1845, the dates given by Strange must be in error for 1844. The earliest steamer to leave Sydney and arrive at the Clarence in time for Strange to collect the specimens was the 'William the Fourth' which left Sydney on 28 August at 7 p.m. (Anon., 1844e). Strange apparently did not return to Sydney to receive Gilbert's box until 29 November (Anon, 1844h).

Gilbert had suggested Strange, *'unpack the box and look at the specimens'* while also removing the seeds for Mrs. Bennett. Strange obviously did this, but at the same time may have added the specimens that he collected on the Clarence River. From these Gould named the Sooty Owl, the eastern subspecies of the Little Shrike-thrush *Colluricincla megarhyncha rufogaster* and the Plumed Frogmouth (Gould, 1845c, 1846a; Ford, 1979). These species were all described at much the same time as Gilbert's material from the Darling Downs, and in the case of the Frogmouth, in the same paper as Gilbert's hybrid Rosella, *Platycercus splendidus*.

From the notes that were taken by Whittell, and comments in Gould (1865), it is evident that Strange collected several other bird species at the Clarence River, though it is not clear whether he did this on the same visit. He also collected some rats and mice on the Clarence. In the same paper as he named the Canefield Rat, Gould named *Mus*

assimilis [= *Rattus fuscipes assimilis*, the south east Australian population of the Bush Rat] from two specimens sent by Strange from the Clarence River. In 1968 the Canefield Rat was discovered in New South Wales near Evans Head, less than 30km north of the mouth of the Clarence River (Keith, 1976). The habitat in the area, swamp forest with grassy understory, heath and eucalypt woodland is continuous between the two areas. Although it cannot be proved, it is possible that Strange also collected the specimens of the Canefield Rat and the New Holland Mouse to which Gould referred.

Also compounding this problem is the uncertain taxonomy of the Canefield Rat and its sibling species, the Pale Field-rat, *Rattus tunneyi*. The Pale Field-rat is similar in size and characters to the Canefield Rat and is still found on both the Darling Downs and the North Coast of New South Wales (Van Dyck & Longmore, 1991; Strahan, 1983). It may be that a revision of these taxa is required to resolve the problem of the identity of these specimens.

Another '*Mus*' was described from material sent to Gould from the '*Darling Downs*'. In 1922 Oldfield Thomas described *Notomys mordax*, the Darling Downs Hopping-mouse, from a skull in the BMNH registered in April 1846 (Thomas, 1922). This specimen had been purchased from Gould and was registered at the same time as the earliest of the BMNH specimens of *Rattus sordidus* and *Pseudomys lineolatus* purchased from Gould (Mahoney catalogue).

Notomys mordax was apparently a distinct species, but at present it remains biologically unknown (Mahoney, 1977). It has never been found again, either as subfossil material or alive, and is believed to be extinct (Strahan, 1983). Although it cannot be stated for certain, it appears that Gilbert collected this single specimen as well. The locality of collection is again unknown, although the original label says '*Darling Downs*' Given the problems with the labelling of the other mice it is just as likely to have come from the Namoi and Gwydir valleys as the Darling Downs, though it is unlikely to have come from the Clarence River as there are no *Notomys* species known from coastal southern Australia.

In 1845 Gould described the dasyurid *Podabrus macrourus* [= *Sminthopsis macroura*, the Stripe-faced Dunnart] from Gilbert's specimens from the Darling Downs. Gould later wrote that Gilbert had said that all the specimens of this species were collected in "the Darling Downs district" (Gould, 1849). Gilbert had given him the Aboriginal name used for the species on the Namoi. This name, '*Toon=moo=ra=la=ga*', does not appear anywhere in Gilbert's diary. Gilbert either obtained this name from his '*natives of the Namoi*' when he was actually on the Darling Downs, or he also collected it near the Namoi. There are three surviving specimens, BMNH 46.4.4.62 (skull only) and BMNH 87.5.4.1 (♀) (formerly LIVCM D275a), both from the Darling Downs; and the lectotype LIVCM D275 (♂) which still has its original label '*No. 10, open plains, Darling Downs*' (Fisher, 1984, pers. comm.).

As noted earlier Gilbert collected a '*small Antechinus*' near Cox's station on the Dumaresq River. Gould (1852) referred to this as a specimen of *Antechinus murinus* [=*Sminthopsis murina*, Common Dunnart]. Mr. Gilbert, who, when writing from the Darling Downs in New South Wales, . says: '*I caught this species on the banks of the river Severn; the male is much larger in all its proportions than the female, and has a darker mark around and before the eye*'. There are two specimens of this species (BMNH 53.10.22.26, BMNH 53.10.22.27), the latter has an original Gilbert label, '*No. 1.? Severn River, New South Wales*'.

Gilbert collected further specimens of this species on the Darling Downs which Gould later described as *Antechinus albipes* [= *Sminthopsis murina*, Common Dunnart] (Gould, 1852). There are two specimens surviving of this species from this locality, BMNH 53.10.22.23, which has an original Gilbert label and LIVCM 1981.35, also probably collected by Gilbert (C.T. Fisher, pers. comm.).

Gilbert's pencilled notes also record the collection of a bat species. Unfortunately he gave no details beyond a dental formula, which by itself is not sufficient to identify the species (T. Flannery & C.T. Fisher, pers. comm.).

In Gould's published works there are few references to birds collected by Gilbert on the Darling Downs. Gould received specimens of the Paradise Parrot collected by Gilbert from this area. Apart from the Liverpool paratype, there is also a specimen of a young male collected by Gilbert on 13 July 1844 in the LIVCM (Fisher, 1986).

Gould also described '*Platycercus splendidus*', now known to be a hybrid between the Pale-headed Rosella *P. eximius palliceps* and the Eastern Rosella *P. eximius eximius* (see Gould, 1846a; McAllan & Bruce, 1989; Schodde, 1989). Gould gave the type locality of *P. splendidus* as

NOTES ON BEHAVIOUR AND DIET OF *VARANUS TERIAE* SPRACKLAND, 1991. *Memoirs of the Queensland Museum 35(1): 128. 1994:-* *Varanus teriae* is 'a species with a very restricted distribution in Australia ... with a maximum geographic distribution of less than 100km ... represented by a relatively large population in a relatively restricted area ... within a national park ...' McDonald et al. (1991). It is known from only three museum specimens and four live specimens in captivity at the Beerwah Reptile Park, SEQ. *V. teriae* occurs only in the upland and lowland rainforests in the Iron and Mcllwraith Ranges, of Cape York Peninsula.

In November, 1993 I observed four specimens of *V. teriae* near the Claudie R., Iron Range. (Three of these were captured for breeding studies). *V. teriae* is superbly adapted to life in the high canopy of the rainforest. It is dark (almost black), lightly built, and small; has an elongate body and long prehensile tail; and its feet bear sticky pads and long digits and claws.

The four specimens were observed at 8.00am, 11.10am, 2.05pm and 4.30pm either on the ground (three) 'raking' leaf litter or searching (?for food) in a rotting log or in a hollow tree limb (one) about 7m above the ground.

The three specimens captured passed faeces which contained insect remains. These have been identified by Dr G.B. Monteith as a tree cricket (family Gryllacrididae) from specimen 1; a single medium sized insect, probably a cockroach (specimen 2); and a 3-4cm longicorn beetle, *Dihammus* (family Cerambycidae), and a mandible possibly from a cockroach (specimen 3). From these remains and from observations in the wild it seems reasonable to suggest that specimens of *V. teriae* forage on the ground amongst leaf litter and rotting logs and that they use their forelimbs to scratch into litter and detritus, to find insect prey.

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Stephen Irwin, Beerwah Reptile Park, Beerwah, Queensland 4519, Australia; *26 February 1994.*

'Darling Downs, New South Wales' but later modified this to *'the newly located district to the northward of the Darling Downs'* (Gould, 1847). When Gould described the bird in October 1845 he had not received any specimens from the Port Essington Expedition, but by the time he changed the locality he had received Gilbert's last collection from Leichhardt. It is likely that Gould altered his account by mistake. The hybrid zone of these taxa is, if anything, to the south of the Darling Downs. In fact hybrids are common in the Texas/Ashford area (pers. obs.) where Gilbert spent over a week while travelling north. Gilbert himself did not consider *'P. splendidus'* new, and he mentioned both the Eastern and Pale-headed Rosellas in his letter to Gould written in June (Fisher, 1985).

On the Port Essington Expedition Gilbert referred a number of times to an *Elanus* sp. which he first recorded on the Darling Downs. Chisholm (1944) suggested that Gilbert did not know the scientific name of the Letter-winged Kite and was referring to this species. Yet the name *E. scriptus* was appended by Gilbert in the Queensland Museum notebook, listed in the pencilled descriptions in the diary and used in Gilbert's letter to Gould from the Darling Downs. It may be that Gilbert saw the related, and more common species, the Black-shouldered Kite *E. axillaris*, while on the Darling Downs.

CONCLUSIONS

Gilbert's apparent inactivity in the few months spent on the Downs is in stark contrast to his earlier trips to Western Australia and Port Essington. On these trips he collected many hundreds of specimens representing numerous new species. In contrast it took him more than nine months after coming ashore at Sydney to record his first Yellow-faced Honeyeater, *Lichenostomus chrysops* (Diary for 17 October 1844). This species is still an abundant species in the forests and woodlands of eastern Australia and was a surprising oversight on Gilbert's part.

This is not to imply that Gilbert was an inadequate field naturalist, merely that he did not actively seek specimens during this period. As binoculars did not then exist, collection of a specimen was the only way he could have become familiar with the smaller birds. He certainly found time to collect specimens while travelling with the stock from Gundemaine. Yet he gave the fairly lame excuse of the weather being "unpropitious" for his lack of collections from the Downs (letter to Bennett 10 September 1844, in Leichhardt papers ML). It may be that he was avoiding field work for other reasons, perhaps due to the tensions between Aboriginals and Europeans in the area at the time, or conceivably he was filling his time helping the Coxens work their stations. The Coxens' fortunes were on the wane at this stage. Stephen Coxen commited suicide in September 1844, ostensibly over his insolvency, while Charles Coxen's property Jondaryan was sold later the same year (Anon. 1844g; French, 1990).

Roderick (1988) suggested Gilbert was limited to only one field of natural history, that of ornithology. However Gilbert's notes reveal that apart from birds, he collected reptiles, fish and shells while he remains extremely important in the history of mammalogy in Australia (Whittell, 1942a,b; *'Contents of box by Shepherd'* envelope to Prince dated 2 May 1840 in NLA; letters from Gilbert to Gould written in Perth 20 May 1839 and in Port Essington dated 19 September 1840 in ML). He also took an interest in plants, possibly to help him describe the habitats in which he found particular animals. Yet he had no way to further his botanical knowledge, given the schedule he kept from 1839 onwards.

Gould's instructions for Gilbert's second visit to Australia indicate that Gilbert was to collect everything from shells, sponges and plants, to seals and *'emus from every locality'* (Longman, 1922). Thus Gilbert's inability to provide beyond merely a *'small collection'* should be viewed in perspective. Gould had an enormous appetite for knowledge and the glory that could be gained from discovery (Tree, 1991). After five years of collecting, perhaps Gilbert had realised that Gould, half a world away, would never be satisfied. He may have felt that he did not need to go beyond the course of duty.

Despite him feeling *'a little jealous of a foreigner being the first to make known the hidden treasures of this vast and interesting country'*, Gilbert's decision to join the Leichhardt Expedition may have been prompted more by a desire to redress the balance (letter to Bennett 10 September 1844 in ML). He had collected few animals in the previous nine months and indeed had found little new on the east coast, though this should not be considered lax on his part. This was an area where naturalists had been collecting specimens for over 50 years. The east coast was neither Western Australia nor Port Essington, where only a limited amount of collecting had occurred prior to his visits.

Gould had instructed Gilbert not to join any Government expedition unless he had it in writing that Gould had rights to any specimens collected and notes taken (draft of letter from Gould to Gilbert dated 14 July 1842 in NLA). In his rush to join an expedition of any sort Gilbert forgot to make such an agreement, a factor which later led to animosity with Leichhardt.

Gilbert's place in the history of Australian biology remains secure. Gilbert's Australian collections and notes, even when limited, give insights into the fauna that existed prior to the full onslaught of pastoralism and introduced herbivores. In this instance, for example, it can be seen that certain species such as the Flock Bronzewing and the Plains Rat were apparently common between the Namoi and Gwydir Rivers where they are no longer found, while the now endangered Paradise Parrot and Bridled Nail-tail Wallaby were found on the Darling Downs. The most unusual animal that may have been collected by Gilbert in this period, *Notomys mordax*, remains as enigmatic as ever.

That Gilbert apparently recorded so little of the Darling Downs fauna may be due in part to trusting his observations to memory. He did this on his second trip to Western Australia, only recording the details in his 'notebook' once he arrived in Sydney. Gilbert's death, Gould's editing of Gilbert's letters, and the mislabelling of his specimens probably guaranteed that there is little known of Gilbert's activities in these months.

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NORTHERN RANGE LIMITS OF THE LONG NOSED POTOROO, *POTOROUS TRIDACTYLUS*. *Memoirs of the Queensland Museum 35(1): 180. 1994*:- The Long nosed Potoroo (*Potorous tridactylus*) is one of several members of the Potoroidae (Potoroinae) (Seebeck et al.,1991). The known distribution of the species extends from southern Tasmania (Heinsohn,1968), through eastern Australia, to SE Queensland (Johnson,1986). The Queensland Museum mammal database indicates that the northern-most, specimen-backed record of *P.tridactylus* is Kiamba (near Yandina) (26°34'S, 152°54'E). Here, we record a sighting of *P.tridactylus* from a forested area approximately 300km NW of Kiamba near where a sighting of the same species has been recorded (Amos,1982).

During October and November, 1993, we completed surveys for the Mountain Brushtail Possum, *Trichosurus caninus* in SE and central Queensland (Lindenmayer & Viggers, unpubl. data). Opportunistic records of other species of mammals were gathered as part of these studies. One of the areas targeted was the Bulburin State Forest (24°33'S, 151°28'E), which is c.25km SW of Miriam Vale. There have been few surveys of the fauna in the area (D. Rolfe, Queensland Forest Service, pers. comm.). During spotlighting transects conducted as part of our surveys of *T.caninus*, an adult *P.tridactylus* was sighted on a roadside verge at the ecotone between rainforest and a plantation of Hoop Pine, *Araucaria cunninghamii*. Attempts to locate *P.tridactylus* during subsequent nights of spotlighting were unsuccessful. Our study indicates that further surveys of the mammalian fauna in the Bulburin State Forest should assess the status of the species.

Acknowledgements

The significance of our sighting of *P.tridactylus* was highlighted during discussions with Mr A.M. Gilmore. Mr S. Van Dyck provided information from the Queensland Museum mammal database. We thank Mr D. Rolfe for allowing access to the Bulburin State Forest, providing accommodation whilst we were working in the area, and supplying unpublished data derived from various studies in the region. We are most grateful to Dr A. Watt for her support of our studies in Queensland. DBL is funded by an Australian Research Council Postdoctoral Award.

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THE FIRST UNDERGROUND MAINS FOR ELECTRICITY SUPPLY IN BRISBANE

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McKenzie, E.D. & Prentice, S.A. 1994 06 01: The first underground mains for electricity supply in Brisbane. *Memoirs of the Queensland Museum* 35(1): 181-192. Brisbane. ISSN 0079-8835.

The first Brisbane underground installation for supplying electricity for lighting is described. The original installation in 1884 used rigid two-core (No. 3 size) Edison street tubes, made in New York, U.S.A. It ran from the Queensland Government powerstation, adjacent to the Government Printing Office, along William Street for about 410m to the Queensland Parliamentary buildings. Various problems caused a two year delay before reliable supply was achieved in 1886. In 1892, when Parliament House was extended, three-core Edison street tubes (No.2 size) were added to the system with each core supplying a separate area of the building. The conductors of the older mains were bonded as a single return circuit to the powerstation. Artifacts from these systems have been collected on three separate occasions, including a planned excavation in January, 1992. Problems with voltage drop in the supply are discussed. □*Edison street tubes, underground electric mains, early electricity supply, Qld Parliament House.*

E.D. McKenzie & S.A. Prentice, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; 15 December 1993.

Rigid underground mains, invented by Edison and known as Edison street tubes, were installed in William St, Brisbane to supply electricity for lighting purposes from the Government powerstation (adjacent to the Queensland Government Printing Office) to the Parliamentary buildings. The first installation, in 1884, was the two-core type and the second, in 1892, was the three-core type which provided for additions to the lighting. These mains were the first and only such installations in Queensland and possibly the only installation of the two-core type in the Southern Hemisphere.

Broken parts of these mains installations were recovered by the Queensland Museum from the powerstation site in 1986, and, in 1989, short lengths of the mains were recovered from the Parliament House grounds during an excavation for plumbing repairs. The work on these materials led to planned excavation and removal of a part of the mains, including complete junction boxes and elbow joint boxes in January 1992. Materials are held in the Queensland Museum.

Over the twenty years of service there was difficulty in selecting lamp voltages in the Parliamentary buildings to suit the variation in the available supply voltage with lighting load. This problem occurred initially with the voltage drop in the two-core mains and later with that for the two and three-core combination.

Units Used

As this paper refers to a time before adoption of the metric and decimal systems in Australia, the following conversions apply: 1 inch= 25.4mm; 1 foot=0.305m; 1 yard= 0.914m; 1 chain=20.1m; 1 sq. inch=645sq. mm; 1 pound (weight)=0.454kg; 1 cwt=50.7kg; 1 pound =2,0 dollars (in 1966); 1 shilling (12 pence)=10 cents.

FIRST STEPS

The first major step taken to introduce electric lighting in Queensland was the decision in April 1883 by the Queensland Government to have incandescent lighting in the House of Assembly and the Government Printing Office in Brisbane.(1) A small trial installation had just been completed in the latter building. A very brief tender, dated 11 April 1883, by a visiting representative of 'The Edison's Indian and Colonial Electric Co. Ltd (Major S. Flood Page) was accepted by the Queensland Government on 13 April. As far as is known, there was no specification. Many details were undecided and no doubt on this account and due to lack of experienced personnel, there was one difficulty after another - a situation which lasted until July 1886 when the installation was nominally complete.(2,3)

The overall plan was for the powerstation to be built adjacent to the Government Printing Office in William St, whence it could conveniently supply direct current at 110 volts (nominal) to the Printing Office and, via underground mains, to the nearby House of Assembly (Fig. 1A). In December 1884 lighting of the Legislative Coun-

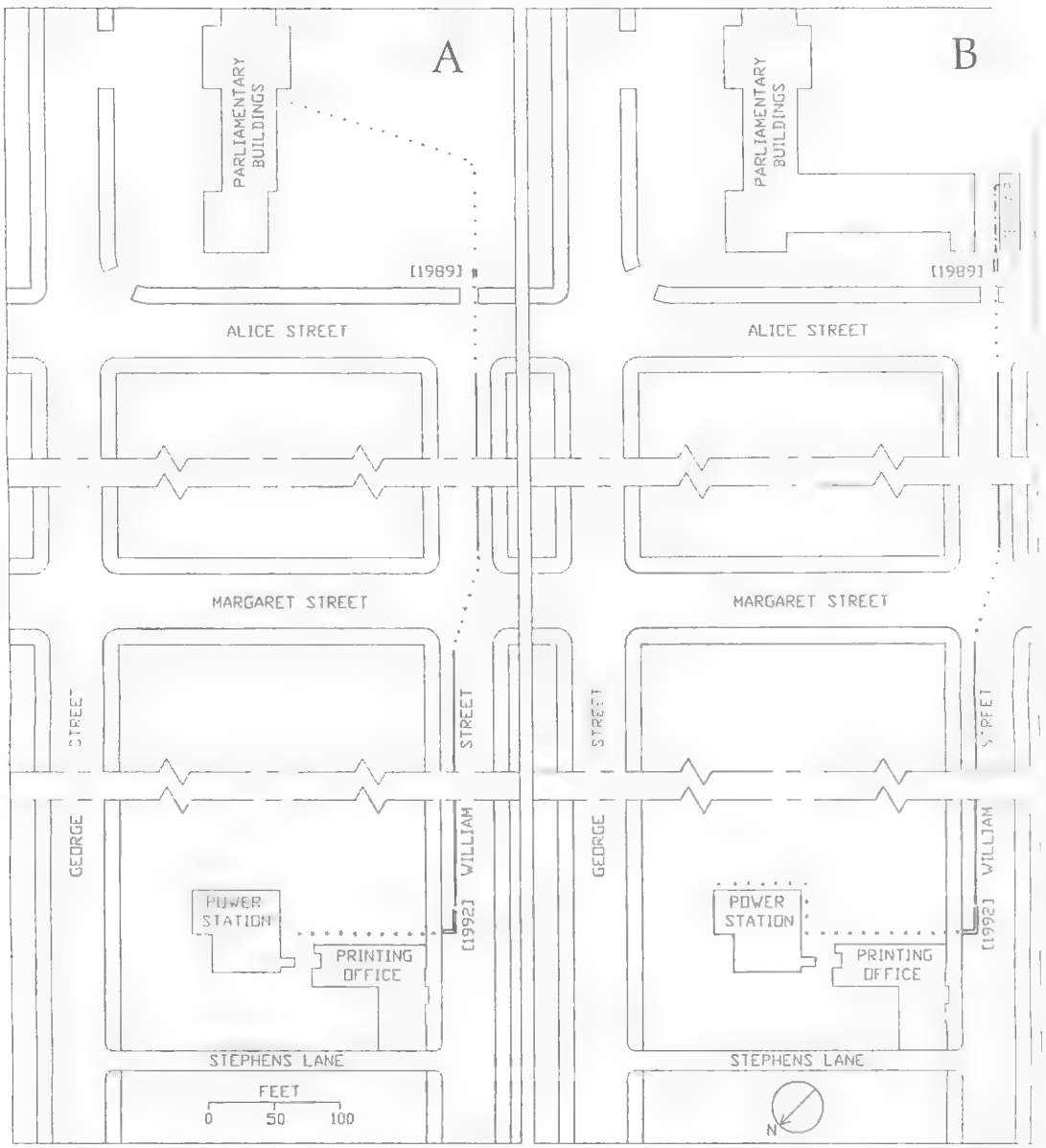

FIG. 1. A, route of the Edison two-core underground mains from the powerstation to the central tower of the Parliamentary buildings, 1884. (Approx. 1350ft). B, route of the Edison two and three-core underground mains from the powerstation to the cellar underneath the extension of the Parliamentary buildings, 1892 and later (approx. 1280ft). (Legend: – Route indicated by cable locater, SEQEB drawing 12261 A1, 1993; = Site of excavations 1989, 1992; -.- Route shown on D.A.S, drawing (Fig. 8); ..... Route otherwise assumed).

cil Chamber was added to the contract. The electrical part of the installation was to be the responsibility of the Edison Co.'s Queensland agents, Messrs Alfred Shaw and Co. The steam plant and the sets of belt drives to the dynamos were to be supplied by Messrs William Adams of

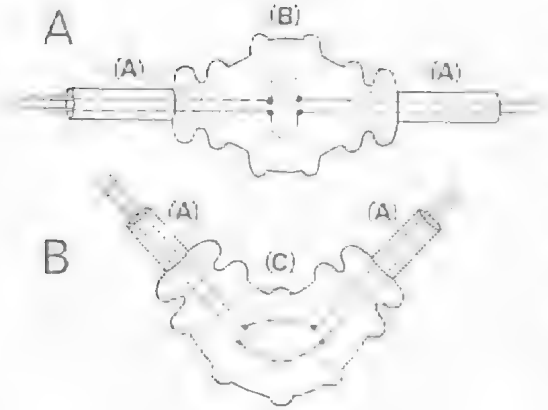

FIG. 2. Components of the Edison underground mains (street tube) two-core system. A, the ends of two street tubes (A) joined by a junction box (B); B, an elbow joint box (C) used for turning the mains at 90°. The street tubes were supplied in 15 and 20ft lengths. In the three-core system, the internal connections are similar to those for B.

Brisbane with the Government Printer responsible for the administration of the contract.(1,3)

The statement by Morwood(4) that the mains were locally made and laid in 1886 is incorrect as is that by L'Estrange(5) that the second installation in 1892 was designed by E.G.C. Barton the part-time Government Electrician. At least until 1894, Barton was responsible for the installation and use of the three-core mains and the maintenance and use of the two-core mains. Both mains (Fig. 2) were designed and manufactured by the Edison Co. in the United States. They were bought from Edison's agents in London with one exception - Barton did apparently manufacture one length of cable in 1892. A memo(6) of 3 June 1892 records a voucher for the payment to Barton, White & Co. of £5-11-10 for 'Parliamentary Buildings New Wing, making 20ft new main'. It is probable that this length of cable was used at one of the terminations of the mains; that it was the only length of three-core cable seen by Morwood or L'Estrange or both; and that this led to the belief that the whole of the three-core mains installation was of local manufacture.

DESCRIPTION OF MAINS

Two-core Mains

The first mains were of the two-core type and were laid in 1884 from the powerstation site, along William St, across Alice St to the tower block of the Parliamentary building.(2,3) The estimated route length is 1350ft. based on the assumed change in direction (Fig. 1A) at Margaret St., and clearance from future Parliamentary Buildings. The mains were not used regularly until 1886. No copy of the order for these has been found but an invoice(7) dated 15 August 1884 from the Edison Co. in London gives details (Fig. 3). Thus there was provision for over 1500ft of mains.

Contemporary publications give details of these Edison tubes; the U.S.A. patent for the two-core mains was applied for(8) in 1881 (Fig. 4); Wormell(9) in 1893 listed 10 different sizes, including the 'No. 3' used in the Brisbane installation; and sections of all ten sizes are given in an 1882 engineering publication.(10) The No. 3 size used copper conductors, each with a cross-section 0.206 sq. inches and tube diameter (probably external) of 2 1/4 inches.(9) It seems likely that the two-core mains supplied to Brisbane were made by the Edison Electric Tube Co., 65 Washington St, New York, the manager being John Kruesi who had been responsible for developing underground mains for Edison.(11)

The Edison tube works was moved from Washington St to Bridge St, Brooklyn, N.Y. in the northern spring of 1884(12). Thus the Brisbane material must have been manufactured at the Washington St factory. Although no direct documentary evidence has been sighted, we presume that the material was shipped from London in 1883. The street tubes were mentioned but not included in the original tender but presumably ordered later. There is documentary evidence that the installation of the cable was to be completed by mid-June 1884. Hyson(13) referred to early installations of two-core Edison mains in 'London, Milan, Brisbane, New York and other U.S. cities'. If this is taken literally, the Brisbane installation was the only one in the Southern Hemisphere.

It is likely that material used in Brisbane was surplus to requirements in London, perhaps having been sent there in 1882. It was the year(14) that the Holborn Viaduct installation was completed in London using the same two-core system. This was soon followed by their first Electricity Lighting Act, which effectively halted any further such developments until it was repealed in 1888. The Act had empowered municipalities to take over such installations without compensation after 21 years. Under such conditions, the Edison Co. in London would have

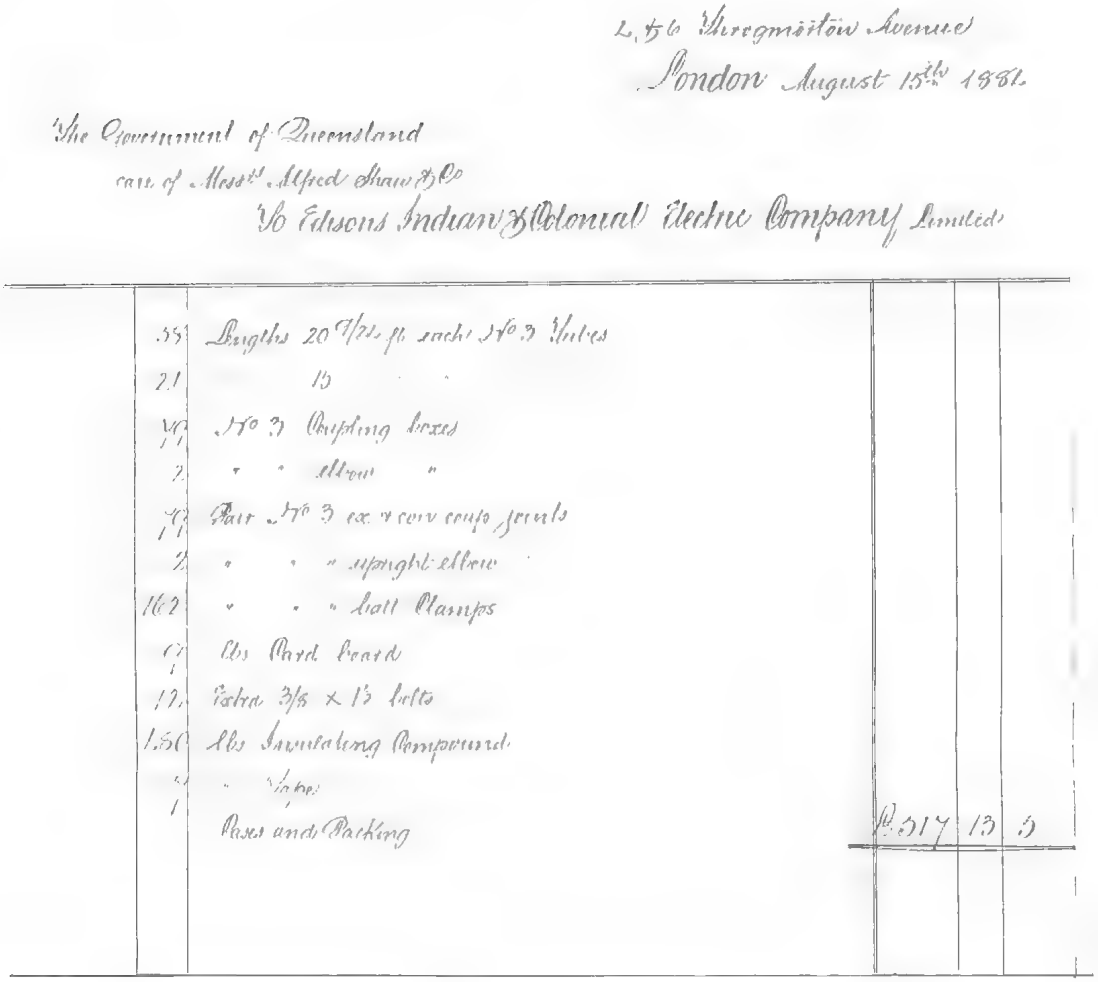

FIG. 3. The 1884 invoice for the supply of the two-core mains and accessories.

been pleased to fill the order from Brisbane with material that it may have had in stock since 1882.

The excavation for the mains in William St and restoration of the road surface were arranged by the Chief Engineer's Office of the Brisbane Municipal Council following approval by the Council in April 1884. Tenders were called and the contract awarded to J. Devenish for the sum of 17 shillings and 9 pence per chain. Work was to commence on 22 May 1884 and to be completed in 20 working days. The excavation, 'nearly 18 chains of trench', was to be 12 inches wide and deep and at every 15 or 20 feet a space 18 inches by 18 inches by 18 inches deep' was to be excavated for junction boxes.(15) From this and instructions for refilling the trench after the mains were laid, it is clear that trenching, installation and testing work must have been coordinated. Presumably J.W. Snow, an American electrician, who had been nominated as the Edison Co. representative and, who was resident in Brisbane at the time, would have been responsible for defining the route, giving the locations of the junction boxes and finally installing the mains. Snow died in Brisbane in September 1884 before the powerstation was completed. No plan of the route has been found other than the Department of Public Works drawing for part of the Parliamentary building. The specification refers only to William St and there is no reference to changes

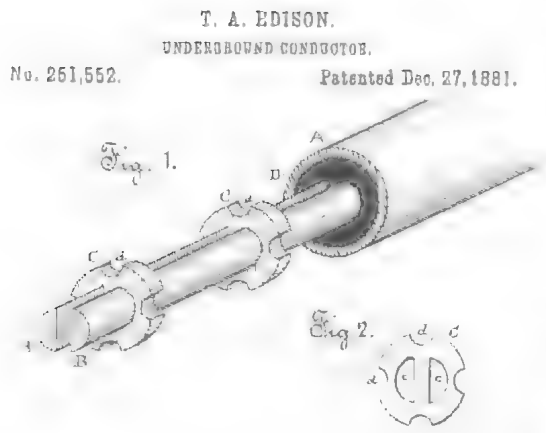

FIG. 4. Part of a diagram of the two-core mains taken from Edison's U.S. Patent.

in direction. A penalty for delay in completing the road work was to be met by Devenish at 5 pounds per week so it is probable that the contract was completed in the 20 days allowed, viz. in June 1884.

The mains had been selected to meet the intended lighting of the House of Assembly with 150 lamps and the calculated voltage drop in the mains (neglecting joints) is about 10 volts. The lighting of the Legislative Council Chamber added 50 lamps giving a calculated drop of about 13 volts. A report on the installation by a consultant in 1886 stated that 'the street mains conductors are of too small a cross-section for their purpose' and that for a generated voltage of 115 the received voltage was 92. The report stated that the lamps were for the latter voltage;also that the cost of adding another street main so as to reduce this drop would be 350 to 400 pounds.(2) There is a conflict between this value of voltage drop and the above calculated value. Further, a report by E.G.C. Barton in 1890, after about 100 lamps had been added to the 1886 installation gave a voltage drop of 25 for a current of 200 amps. (16) Inconsistencies may be due to the resistance of unsoldered connections in the system and/or errors in measurements. However, the few joints in the mains which we have seen to date appear to have been well soldered.

THREE-CORE MAINS

Because of the voltage drop problem, the Government Printer had been requesting an additional set of mains for some years when in July 1891, with the extensions to the Parliamentary buildings in progress, a specification was prepared by the Department of Works on a basis of doubling the cross-section of the mains and thus halving the voltage drop for the same current. The specification reads as follows: 'The contractor is required to provide 420 yards of Edison's three-wire street tubing in 15ft or 20ft lengths. Resistance of 420yds to be with all wires bunched in parallel, about 0. 03 ohms, so that a current of 280 amperes will experience a drop of about 8 volts. The tubing is to be provided with the required number of couplings and junction

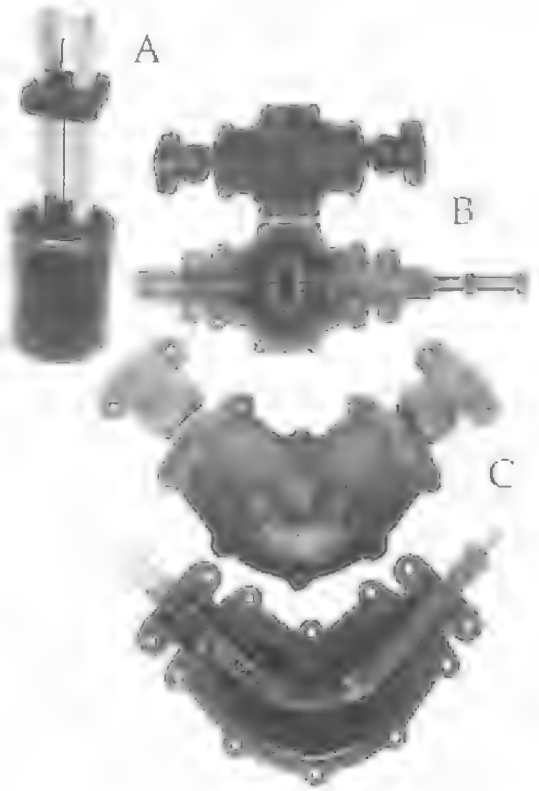

FIG. 5. Some of the material from the two-core mains, as found in Brisbane. A, a section of the Edison cable, showing how the copper conductors, with pasteboard separators held in place by a thin cord, were contained in an iron tube, filled with insulating compound; B, the junction box showing the method of joining the conductors to allow for thermal expansion or contraction of them; C, the elbow joint box - conductors here are atypical with a single-core multistrand cable joined to the older two-core system after the latter was used as the return circuit of the upgraded system in 1892. Scale is given by the 2 inch iron tubes.

FIG. 6. Some of the material from the Edison three-core mains. A, a sectioned length of cable showing the use of spiral rope, both to insulate and separate the conductors; B, the various parts of a junction box showing the use of flexible multistrand cable to join the conductors; C, the various parts of an elbow joint box. Scale is given by the 2 inch iron tubes.

boxes, including three right-angle junction boxes, also sufficient bitumen (for tropical climate) to fill all junction boxes. An extra amount of 2cwt required above that sufficient for the new main'.(17) The indent was placed in London by the Agent General for Queensland with the Brush Electrical Engineering Co, who held the Edison patents for the Colony, for one pound per yard. The mains were delivered in Brisbane in November 1891.(18)

Each conductor is now known to be 0.12 sq. inch which agrees reasonably with that implied by the specification. Hence the three-core mains had a total area of 0.36sq.inch compared with that of the two-core mains of 0.41sq. inch.

The use of three-core mains by the Edison Co. in New York in late 1882 followed the introduction by Dr John Hopkinson in that year in England of the three-wire d.c. system.(11) It was a means of decreasing the voltage drop in the distribution system while still supplying approximately 110 volts to consumers. Thus the two-core system became obsolete.

On 8 December 1891, approval was given by the Department of Public Works for the laying of the new mains between the Printing Office and the Parliamentary buildings by day work 'under the personal supervision of the Government Electrician [E.G.C. Barton], as it is of the first importance that this work should be most satisfactorily carried out. Prices might be obtained for opening and closing of the trench along the streets at per chain'.(17) The new mains were to be laid alongside the old mains.(19) There is an intriguing request(20) by the Colonial Secretary for 'the return of the excess of 31ft supplied over that ordered'. This is apparently in conflict with the evidence already given that Barton built another length of cable for the system. However, it seems more probable that both documents indicate changing ideas about the detail of the installation as work progressed. Whereas the extra cable may have been in excess of requirements initially, the later decision to extend the underground mains around the powerstation would probably have been based on the availability of this material.

The work was completed by May 1892 after some delays for lack of components and materials needed for the completion of the three-core mains between the powerstation and the cellar in the Parliamentary grounds adjacent to the Alice St gates. Also, rerouting of the two-core mains both at the powerstation and near the Alice St entrance to the new building was needed.(21) Details of the extra material needed are seen in some of the archival material sighted. In early March, 1892, a request(21) was made for authority to cover some of the expenditure. 'The 6 sets of small junction boxes and 5 sets of Ends, where (sic!) required for the extension of the old Electric Light Main and to make good broken parts. The 3 sets of Large Junction Boxes where (sic!) required for extending the New Main round the Engine Room....' An added note by the supervising architect says that 'The fittings referred to were necessary and urgently required to complete the connection of the old and new electric mains with the dynamo at the printing office'. The estimated route length is 1280ft (Fig. 1B) based on the assumed transition at Margaret St.

Considerable work must have been done on the old mains, for as well as the extra two hundredweight (224lbs) of insulating compound ordered with the new material(17) another request(22)

was made in February 1892 for a further supply - 'the supply of Asphaltum will need replenishing as the supply sent with the mains has been used up and another cask will have to be obtained from Sydney where the Callender Bitumen Company would I believe be the proper people to apply to.' An added note says that the cost of this would not exceed 40 shillings. No doubt it was Barton's decision that, when installed, the three cores should be used as one pole and the two cores of the first mains bonded to provide the other pole of the new arrangement. It was reported that one of the cores of the new mains would supply the new wing of the Parliamentary buildings, another the Assembly and the third the Council Chamber.(23) There was a complaint that turning off the Council lamps caused a general flickering of the Assembly lamps for some minutes. The proposed remedy was to turn off the Council lamps from the powerstation switchboard by means of the available separate circuit; presumably the station voltage could then be quickly adjusted.(24)

The first trial of the new lighting in the extended buildings in June 1892 showed that the station voltage of 115 was reduced to 94 volts. The recorded current was 240 amps corresponding to about 400 lamps.(23) The calculated value of the received voltage based on conductor sizes is approximately 100 so the result must have been disappointing particularly to Barton in his dual role as part-time Government Electrician and contractor for the lighting of the new wing.

Throughout the many years of operation of the lighting system, the only solution to acceptable lighting in the many rooms of these buildings was to select lamps of lower voltage for the Parliamentary buildings than for the Printing Office. Deciding what voltage lamp should be put in what part of the building and what combination of lights should be turned on at a given time must have been a constantly recurring problem. To illustrate this it is relevant to note that in June 1892 Barton requested replenishment of lamps used in the Parliamentary buildings quoting existing stocks of lamps of voltages 92, 96, 98 and 110. In the previous year there was an indent to 'provide 100 Edison lamps with screw sockets, 16 candle power, 110 volts, also 150 Edison lamps, screwed sockets, 16 candle power, assorted 93, up to 98 volts'.(17)

MATERIAL RECOVERED

Prior to the publication by one of us (S.A.P.) (3) of a history of Edward Barton - the engineer whose name is most closely associated with this installation - we had not sighted intact samples of the underground mains or joints. The construction details were assumed to have been those given in a paper by the late F.R. L'Estrange, Consumers' Engineer, Southern Electric Authority of Queensland, who had presumably examined the disused mains.(5) The construction due to L'Estrange was reproduced on the assumption that it was correctly represented.(3)

FIG. 7. The 1992 excavation of part of the mains in William Street in progress. The elbow joint boxes are seen in the foreground. The straight junction boxes are not yet exposed at the further end of the trench. The tall building in the background is the modern (1980s) extension to the Parliamentary Buildings. The sharply pitched roof of part of the 1892 extensions is just visible above the tree-line.

In November 1986 a short damaged length of the two-core mains and a damaged three-core junction box with part of a three-core mains were discovered by the Queensland Museum at the old powerstation site (adjacent to the Government Printing Office). This showed that the conductor arrangements illustrated in the above two references were approximately correct. However, details of the insulation were not clear. Details of

FIG. 8. Detail from part of a drawing (Dept. of Admin. Services, No. SH727, undated) showing the route of the two and three-core mains in the vicinity of the Alice Street entry to Parliament House and the entry to the wine cellar (see Fig. 9).

the three-core junction box and the internal flexible connectors were in agreement with those in a contemporary publication.(25)

In June 1989 two short lengths, one of each type of mains and evidently from the original installations, were uncovered and removed during an excavation by the Department of Works several feet inside the Alice St gateway to the Parliamentary buildings.

The two mains were found at the same depth about 10 inches apart, but circumstances did not permit the recording of full details. Four foot lengths were sawn off, and it was clear that both cables had been previously roughly severed many years before at the Parliament House end - only a few feet from the steps up to the passageway, which has replaced a previous carriageway at this point. (Thus any remaining cable within the building area (Fig. 8) is now a further few feet under the fill used here.)

The conductor details were in agreement with the pieces recovered earlier but the insulation details differed considerably from those concluded by L'Estrange.(5) Possibly the sections described by him related to terminations but not to the general run of the mains. As noted previously, he may have seen only the one piece of three-core mains that had been manufactured by Barton.

The construction of the two-core mains agrees with that described in a patent application by Edison in 1881 (Fig. 4).(8)

A contemporary textbook summarises details of the mains and junction boxes as follows: '.... the conductors were copper rods whose cross-sections were segments of circles. These were placed in wrought-iron tubes filled with insulating material and having on the outside tarred ribbons wrapped around them to prevent the oxidation of the iron. To hold the copper in position, perforated paste-boards were arranged at intervals. These conducting tubes were manufactured in lengths of 20ft and connected to each other [by junction boxes]. The copper bars protruded about 2in. from every tube and were connected by means of U shaped pieces so as to allow of the expansion and contraction of the metal;the whole was covered up by a cast iron box filled with insulating matter.'(9)

The construction of the two-core mains, revealed by our further study of them, agrees with this description (Fig. 5) except for one detail;we have looked for, but not found, evidence of the wrapping of the outside surface of the tubes with tarred ribbons.

The three-core mains are also described in a contemporary periodical.(26) 'The conductors or core of the tube are copper rods which are drawn into convenient lengths so that in the first instance each can have a layer of thin rope twisted around, and afterwards the three rods are similarly treated and placed in the wrought iron tube which resembles a gas pipe. The outer windings of the spiral come into contact with the inside of the tube and a liquid insulating material is then poured in which flows along the spiral convolutions of the cord thoroughly saturating them, and insulates the conductors from each other and from the tube... A pair of clamps are fixed on the end of the length of pipe, and furnishes it with a ball end, which rests into a hollow in the coupling box with the double object of making the joint and allowing a certain amount of elasticity, which is checked by the rib of the coupling box. To allow for expansion, the connections in the box are of stranded coppered (sic!) wire preferably of higher resistance than the copper in the mains so that the heat developed will cause the insulating material with which the box is filled to be softened.' Another contemporary description states that the flexible connections are screwed to the mains by means of set screws running through copper castings on their ends. 'After the connectors are in place they are thoroughly soldered to the ends of the mains thus making the electrical joint. The covering of the egg-shaped casting is screwed down upon the lower half;and by means of a small hole in the top of the casting, the whole of the box is filled full of melted insulating compound, thus forming an absolutely watertight joint.(25)

FIG. 9. A computer-enhanced photograph, taken from an original held by SEQEB, of the remains of both the two- core and the three-core systems emerging from the wall of the cellar of Parliament House (cf. Fig. 8). These were destroyed during the 1980s renovations of this building.

Details of the recovered tubes and fittings are in agreement with the foregoing descriptions. They are illustrated in (Fig. 6).

Missing from the earlier discoveries were a two-core junction box, a complete three-core junction box and two and three-core elbows. Interest in completing the array of components led to agreement by the South East Queensland Electricity Board (SEQEB) to undertake a search for the original mains in William St using a locating device which detects underground metal pipes. In January 1992 a likely site for the mains and elbows was discovered adjacent to the site of the original powerstation. An excavation exposed lengths of both types of mains, both types of junction boxes and both types of elbows, all virtually undamaged (Fig. 7).(27)

Although there are some corrosion problems with the cast iron material, it is in surprisingly good condition after spending a century in such a shallow location underground. Undoubtedly we have been fortunate that this street was never chosen as a route for Brisbane's extensive electric tramways system.

One unexpected result of the 1992 excavation was the discovery that the cable running from the two-core elbow joint box, where the mains turned at 90° towards the powerstation, was not a two-core cable but a lead-sheathed, paper insulated stranded copper conductor comprising 37 strands of 12SWG wire to form a single return circuit. This was proof of the bonding of the two-core cable conductors to form a single return line. The archival material reveals (28) that one 20ft length of cable was replaced in 1894. It is reasonable to assume that the length replaced was this one.

The insulating compound used in these mains is said(12) to have been a mixture of refined Trinidad lake pitch, oxidised (with lead oxide) linseed oil, beeswax and paraffin wax - a combination that was decided upon after an exhaustive search for the best available insulating compound by Edison's team in 1881. Chemical details of insulating materials will be reported elsewhere but the main points are: firstly, a confirmation of the documentary source of most of the materials used; secondly, there is a consistent difference in viscosity of the compound between the earlier and the later systems - the two-core tubes contain a significantly more viscous compound than the three-core tubes; and finally, there are differences in the compound used in the several junction boxes studied. The latter differences are consistent with the compound used to fill the junction boxes having come from different sources, as already noted.

ROUTE OF MAINS

No complete record of the route of the mains has been found. Known and assumed details (Fig. 1A,B) have been obtained from documentary evidence, the 1989 and 1992 excavations and the SEQEB field survey(27).

For much of the route the three-core installation apparently paralleled that of the original two-core mains. However, both at the powerstation end, and at the Parliament House end, the two-core system had different terminations, most of the details of which are now lost.

For the Parliament House end we have some details of the 1892 terminations in a drawing and in a photograph. A Department of Public Works (now Administrative Services) drawing No. SH727 (undated) shows the route of the two types

FIG. 10. A "Harper's Weekly" illustration of the laying of the original Edison underground mains in New York, U.S.A. These supplied electricity over a square mile of Manhattan from the Pearl Street generating station in 1882.

of mains near the point of recovery of short lengths in 1989 and also the entry into a cellar within the Parliamentary buildings area, adjacent to the Alice St gates (Fig. 8). The entry is shown in a 1936 photograph (Fig.9), held by the SEQEB Historical Records. Nothing remains of these terminations: they were taken out and discarded when the walls of this cellar were relined during the major re-furbishment of Parliament House in 1982. Neither the foreman-in-charge nor the supervising architect has been able to supply any useful details of these cables. However, it seems likely that elbow joints for both the two-core and three-core system remain behind the cellar wall. The ground outside the cellar (the original carriageway) was not disturbed during the building work.

Interpretation of the computer enhanced photograph (Fig. 9) appears to add little of substance. The termination of the three-core system was completely lost by the time of the photograph - the ropes used for insulating the separate conductors can clearly be seen. However, for the two-core system something of the terminal arrangement appears to remain. The structure clamped or soldered to the ends of the two-core mains appears to represent part of the fitting used to bond these mains to the internal wiring. But the detail is too unclear for further speculation.

The original route of the two-core mains evidently passed in the immediate vicinity of the site of the cellar (part of the additions to the Parliamentary buildings) as there is a reference to rerouting the mains in 1892 to avoid this.(21) This is the only detail we have of the route of the original two-core mains in the grounds of Parliament House. The position of the original termination has not been identified but there is a reference (2) to the main leads from these 'street tubes' as running 'up the reporter's gallery stairs'. The latter are adjacent to the central tower of the building which then consisted only of the George St frontage.

The positions of the excavations made in 1989 and 1992 (Fig. 1A,B) help to define the route,

much of which is based on a SEQEB survey using an electronic locating device. It seems probable that the underground two-core mains originally terminated immediately inside the SW wall of the powerstation building and were continued to the dynamo room in surface wiring.(21)

There appears to be no obvious reason for the route of the original mains changing from one side of William St to the other. The discontinuity at Margaret St as shown by the locater and the indicated change in the route to the opposite side of William St there suggests that either elbows were inserted at Margaret St and some 24ft of the mains were thus transverse to the general run or else the mains may have been set to curves to suit the two changes of direction as indicated. The fact that only two elbows were listed in the invoice for the whole installation of the two-core mains suggests that the mains were set in the latter way. An artist's impression of the laying of the street mains in New York in 1882 is given in Harper's Weekly (Fig. 10).(29)

The specification for the excavation in William St for the two-core mains required an excavation depth of 12in. W.M.E. L'Estrange commented on the heat of the sun melting the bitumen out of the mains and on the ingress of moisture attributable to the depth of laying being too shallow.(3) A contemporary description of practice in New York gave the depth of laying as 2ft to 2ft 6in. and this is also suggested by Fig. 10. In confirmation of L'Estrange's comments, archival records indicate problems in the first several years of use of the two-core mains as it was stated in 1891 that advantage should be taken of the opening up of William St for the installation of the second mains to overhaul the earlier mains.(19) Location of faults due to breakdown of insulation or a defect in any of the several hundred conductor joints would have required extensive trenching.

DISUSE OF MAINS AND LOCAL DEVELOPMENTS

The mains were disused by March 1907 by which time the Parliamentary buildings were receiving supply from the Ann St powerstation of the City Electric Light Co. Ltd.(30) The company had replaced its original 110 volts direct current distribution system with a 220/110 volt three-wire direct current system some ten years earlier.(3)

The type of mains discussed in this paper became obsolete as lead sheathing was substituted for iron pipes and long lengths were thus available by an extrusion process. Lead sheathed mains were in use in 1891.(31)

In central Brisbane, in 1899, the first such mains were laid by the Brisbane Electric Supply Co. Ltd along footpaths in hardwood troughs and covered with bitumen. This company's successor, the City Electric Light Co. Ltd. used 220/110 volt underground mains, installed in George Street, to supply the Parliamentary buildings (as mentioned above) and later the Printing Office. This advance in technology brings into sharp contrast the relative installation and maintenance costs as well as the improved reliability of the later as compared with the earlier types.

Two years after the initial lighting of the Parliamentary Buildings the first commercial supply of electricity in Brisbane was given by a small newly-formed firm of electricians, Messrs Barton, White and Co. (later Brisbane Electric Supply Co. Ltd).(3,32,33) They provided electric light for the General Post Office on 20 August 1888. Overhead lines were used to connect the generating plant with consumers over the next eleven years, without formal approval. Thereafter the company was obliged to conform with the Queensland Electric Light and Power Act of 1896 which required all mains to be underground. It was not until 1917 that overhead distribution mains were accepted, thus bringing electric lighting to the streets of Brisbane thirty five years after the first demonstration in Queen St.(3)

CONCLUDING COMMENTS

The Queensland Government must be credited with the initiative and foresight which resulted in the Edison Co.'s representative in Brisbane obtaining an order to light partially the Government Printing Office in April 1883, using the Edison system. This was followed immediately by the representative securing an order to light Parliament House using Edison equipment, except for the steam plant driving the dynamos.

Edison had succeeded in factory production of both dynamos and incandescent lamps by 1879. To complete the development, a system of distribution, to connect the powerstation with the consumers, was necessary. The first patent for the two-core Edison street tubes was filed in 1881; and in 1882 working systems using these street tubes were installed and operating in both New York and London. Brisbane was not far behind: considering the slower communications of the period, it is reasonable to argue that Brisbane was in the forefront of electric lighting.

This early Brisbane installation helped indirectly to promote electric lighting as a community need rather than a novelty and thus created a demand for public supply, the name of Barton being linked with all but the earliest phases. The high cost and inferior reliability of electric lighting compared with gas lighting at this stage was offset against the absence of heat and fumes.

ACKNOWLEDGEMENTS

We thank the State Department of Administrative Services for providing early drawings of the relevant buildings and services and for their assistance with the initial recovery of the mains. We are also indebted to the The South East Queensland Electricity Board for undertaking in 1992 the identification of the route of the mains in William St, for recovering complete sections of these and for providing photographs. Permission from the Victorian State Library for reproduction of the illustration from Harper's Weekly is gratefully acknowledged.

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NOTES ON SOME INDO-PACIFIC UPOGEBIIDAE WITH DESCRIPTIONS OF FOUR NEW SPECIES (CRUSTACEA : THALASSINIDEA).

NGUYEN NGOC-HO

Ngoc-Ho, N. 1994 06 01: Notes on some Indo-Pacific Upogebiidae with descriptions of four new species (Crustacea: Thalassinidea). *Memoirs of the Queensland Museum* 35(1): 193-216. Brisbane. ISSN 0079-8835

Eleven species of Upogebiidae from New Guinea, New Caledonia, Kenya, Madagascar, Japan, Taiwan, Singapore and Vietnam have been studied. Four are new: *Gebiacantha multispinosa*, *G. lifuensis*, *Upogebia sakaii* and *U. spinimanus*. The seven additional species include: *Gebiacantha laurentae* Ngoc-Ho, *Upogebia narutensis* Sakai, *U. pugnax* de Man, *U. savignyi* (Strahl), *U. wuhsienweni* Yu, *Wolffogebia inermis* Sakai, *W. phuketensis* Sakai.□*Crustacea, Thalassinidea, Upogebiidae, new species, Indo-Pacific, taxonomy.*

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This work provides further information about the rich upogebiid fauna of the Indo-Pacific (de Man,1927,1928; Poore & Griffin,1979; Sakai,1982; Ngoc-Ho,1990). Collections examined come from: New Guinea (*Gebiacantha laurentae* Ngoc-Ho); New Caledonia (*G. multispinosa* sp.nov., *G. lifuensis* sp. nov., *Upogebia pugnax* de Man); Kenya (*U. savignyi* (Strahl); Madagascar (*U. spinimanus* sp. nov.); Japan (*U. sakaii* sp. nov.); Singapore (*Wolffogebia phuketensis* Sakai); Taiwan (*U. narutensis* Sakai, *U. wuhsienweni* Yu); and Vietnam (*W. inermis* Sakai) The latter species was previously known only from the holotype which cannot be located. Its examination, together with that of *W. phuketensis*, adds generic features of *Wolffogebia* unmentioned by Sakai (1982).

New material of *Upogebia savignyi* confirms its synonymy with *U. rhadames* Nobili (Sakai, 1982). The first available adult female of *U. pugnax* described in this work gives further information about this species. *U. narutensis* and *U. wuhsienweni*, both reported for the first time from Taiwan, are very similar to each other and also to Taiwanese *U. edulis* Ngoc-Ho & Chan,1992.

Measurements given (mm) in the descriptions are: carapace length (cl.) = tip of the rostrum to the posterior border of the carapace; total length (tl.)= tip of the rostrum to the posterior border of the telson. Terminology of descriptions follows Ngoc-Ho (1981).

ABBREVIATIONS USED: BMNH, British Museum (Natural History), London; MNHN, Musèum National d'Histoire Naturelle, Paris; NNML, Nationaal Natuurhistorisch Museum, Leiden; NTOU, National Taiwan Ocean University; QM, Queensland Museum, Brisbane; UMK, Universitetets Zoologiske Museum, Kobenhavn; USNM, U.S. National Museum, Washington, D.C.; ZSM, Zoologische Staatssammlung, München.

SYSTEMATICS

Family UPOGEBIIDAE Borradaile, 1903

Gebiacantha Ngoc-Ho, 1989

Gebiacantha laurentae Ngoc-Ho, 1989
(Fig. 1)

Gebiacantha laurentae Ngoc-Ho, 1989: 140, fig. 9.

MATERIAL EXAMINED

Sek Harbour, New Guinea, St. 62, 37m, mud with a little sand, W. Stephenson coll., 17.10.1969: ♀, cl. 7.5mm, tl. 18.5mm (QMW3317).

DISTRIBUTION

Indonesia (Makassar Detroit) and now Papua New Guinea. This record marks an easterly range extension.

REMARKS

The specimen examined agrees well with the female paratype of the species though it is slightly larger and has all spines comparatively more prominent. It also has 2 ventral spines on the 4th article of the antenna while the type has only one. The specimen is covered with mud and sediments although the area is dominated by soft corals and sponges (P. Davie, pers. comm.). Nothing is known of its ecology.

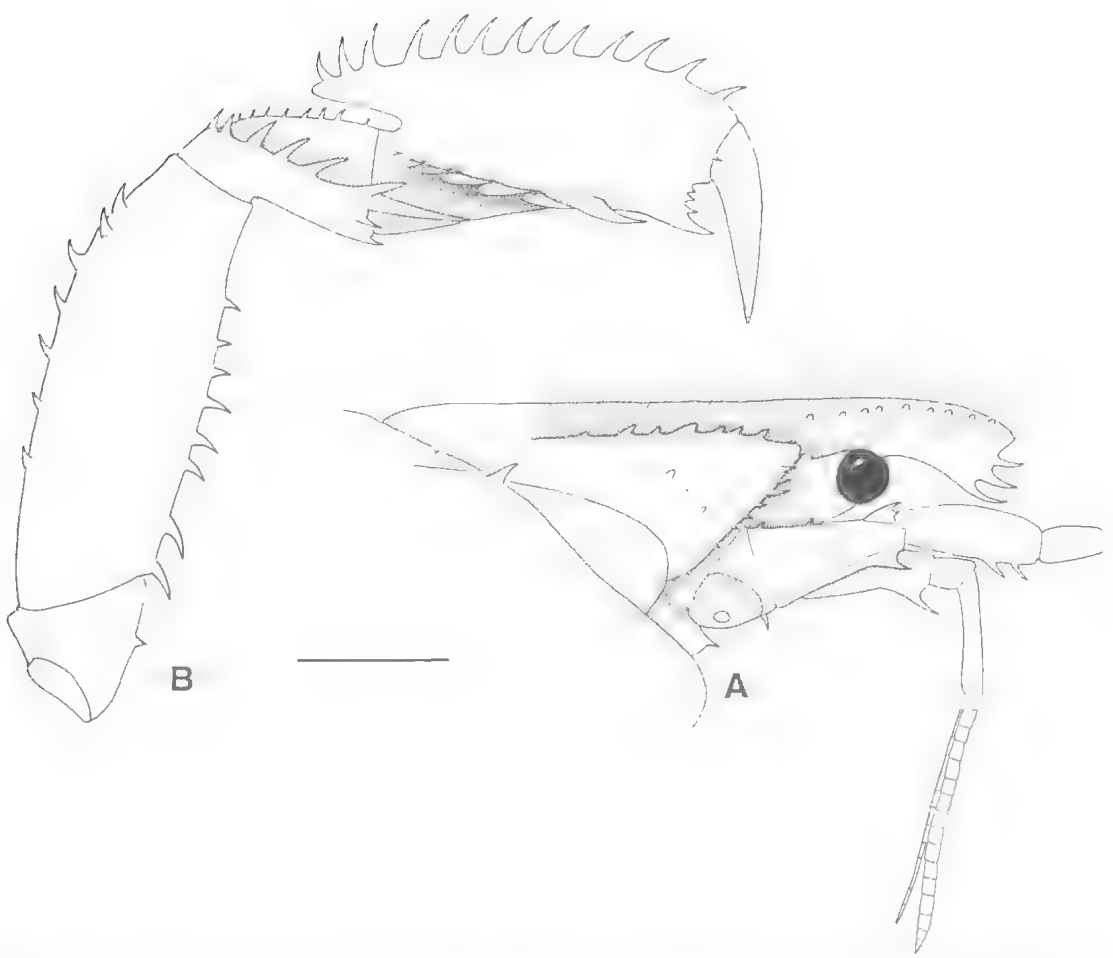

FIG 1. *Gebiacantha laurentae* Ngoc-Ho, female, QMW3317. A, anterior part of carapace, lateral view; B, first pereopod, mesial view. Scale line: 1mm.

Gebiacantha multispinosa sp. nov.
(Fig. 2)

MATERIAL EXAMINED

HOLOTYPE: New Caledonia: Loyalty Islands (Ouvéa), J.P. Menou coll., 16.11.1991, depth 6-10m: ovigerous ♀ ,cl. 11.5mm, tl. 32.5mm (MNHNTh1255).

PARATYPE: same data as holotype, ovigerous ♀ : cl. 10.5mm, tl. 28.5mm (MNHNTh1256).

ETYMOLOGY

Referring to the numerous spines present on the body and pereopod 1.

DESCRIPTION

Rostrum triangular, projecting far beyond eyes, with 6-7 spiniform dorsal teeth on each lateral border; 3 large ventral spines. Fine and faint medio-dorsal groove (slightly dilated anteriorly) on rostrum and anterior part of gastric region, followed posteriorly by bare, unarmed, longitudinal, low elevation. Lateral groove moderately broad, lateral ridge with 9-10 spiniform teeth or tubercles. Linea thalassinica distinct, extending to posterior border of carapace. Anterolateral border of carapace with 5-6 spinules. Anterolateral region of carapace (limited anteriorly and dorsally by anterolateral border and lateral ridge, posteriorly by linea

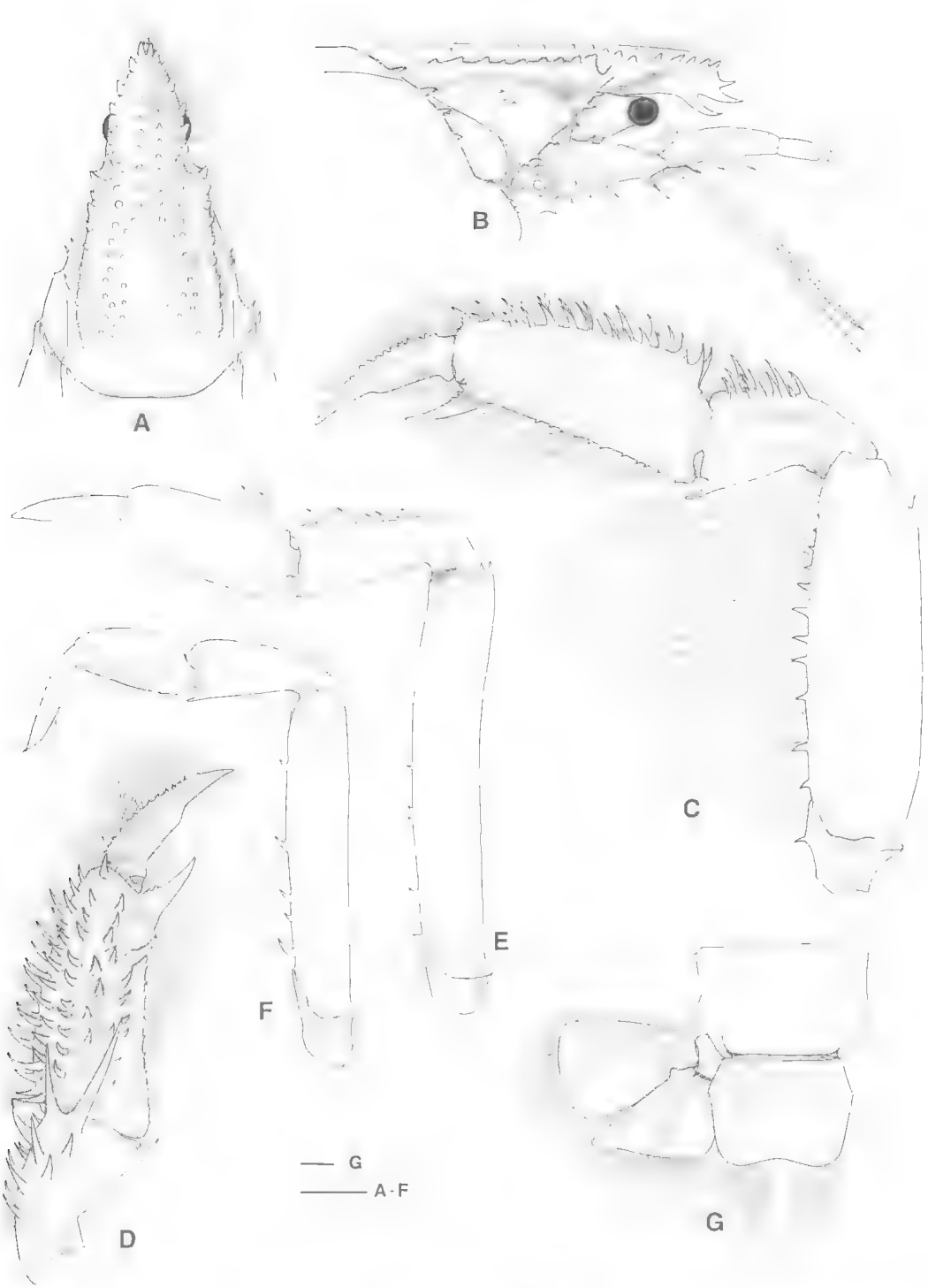

FIG. 2. *Gebiacantha multispinosa* sp. nov., holotype, ovig. female, MNHNTh1255. A,B, anterior part of carapace, dorsal and lateral view; C, pereopod 1, external view; D, distal part of pereopod 1, mesial view; E,F, pereopods 2 and 3 respectively; G, telson and uropod. Scale line: 1mm.

thalassinica) with 2-4 spines and spinules. Cervical groove deep, bearing 5 proximal spines and 2 distal spinules on either side. Epistome terminates dorsally in spinule.

Telson approximately 1.4 times as broad as long, lateral borders convex, postero-lateral angles rounded, posterior border concave medially, very faint inverted U-shaped carina on dorsal surface.

Antennule. (Fig. 2B). First peduncular article with large ventro-distal spine.

Antenna. (Fig. 2B). First, third and fourth peduncular articles with 1, 3 and 3 ventral spines respectively; second article with dorsal spine, scale terminating in 2 spinules.

Pereopod 1. Subcheliform. Ischium with ventral spine. Merus over 3.5 times as long as broad, bearing dorsal subdistal spine and 11-12 ventral spines. Carpus with fine longitudinal groove on upper part of external surface, ventral subdistal spine, 2 large mesial subdistal spines, and 11-13 spines or spinules along or near dorsal border. Propodus over twice as long as broad with spinules on proximal two-thirds of ventral margin; external surface with small ventro-distal spinule between base of fixed finger and dactylus; mesial surface bearing roughly 6 longitudinal rows of 8-10 spines, 4 lower rows distinct, upper 2 with spines more or less mixed up; large lower spine behind fixed finger, smaller upper one near base of dactylus; fixed finger about half as long as dactylus, bearing 2-3 small proximal teeth. Dactylus over half as long as propodus, with tubercles along upper border; cutting edge with small triangular flat tooth near mid-length; corneous tip.

Pereopod 2. Merus over 5 times as long as broad, dorsal distal spine, 4-5 ventral spines and spinules. Carpus with ventral subdistal spinule and 6 spines along dorsal margin. Propodus approximately rectangular, over twice as long as broad, 1-2 proximal dorsal spines.

Pereopod 3. Merus over 5 times as long as broad, 5-6 ventral spines. Carpus with ventral distal spine. Propodus with faint longitudinal carina on lower half. Dactylus with comb-like setae on distal half of ventral border.

Uropod. Exopod a little longer than telson, posterior border nearly straight, not continuous with lateral external border; endopod approximately triangular, protopod with spinule.

TYPE LOCALITY

New Caledonia (Loyalty Islands), 6-10m.

REMARKS

This species is similar to *G. lifuensis* sp. nov. described below and both are similar to *G. acanthochela* (Sakai, 1967) from Japan. The comparison is made under *G. lifuensis*.

Gebiacantha lifuensis sp. nov.
(Fig. 3)

MATERIAL EXAMINED

HOLOTYPE:New Caledonia: Loyalty Islands (Ouvéa), J.P. Menou coll., 16.11.1991, depth 6-10m; ovigerous ♀, cl. 11.5mm, tl. 33mm (MNHNTh1257).

ETYMOLOGY

From the type locality, Loyalty Islands.

DESCRIPTION

Rostrum approximately oval, projecting far beyond eyes, bearing 6-8 spiniform teeth on each convex lateral border; 4 large ventral spines. Short and faint medio-dorsal groove on rostrum; rounded tubercles in longitudinal rows on posterior part of rostrum, gastric region, and alongside lateral groove. Gastric ridge with 9-10 spiniform teeth. Anterolateral border of carapace with 5 spinules. Cervical groove distinct, shoulder lateral to it bearing spine near intersection with linea thalassinica, latter extending to posterior border of carapace.

Telson about 1.4 times as broad as long, lateral border convex, posterolateral angles rounded, posterior border concave medially, very faint inverted U-shaped carina on dorsal surface.

Antennule (Fig. 3B). First peduncular article with 1-2 ventral spines.

Antenna (Fig. 3B). First, third and fourth peduncular articles carrying 1, 3 and 3 spines respectively; scale terminating in 2 spinules.

Pereopod 1. Subcheliform. Ischium with ventral spine. Merus nearly 4 times as long as broad, with single upper subdistal spine; 6 spines and 2 spinules on lower border. Carpus with shallow longitudinal groove on external surface; ventral distal spine; 3 large subdistal spines (1 dorsal and 2 mesial); 8-9 smaller spines along, or near, dorsal border. Propodus about 2.5 times as long as broad, with a few proximal tubercles on ventral border and large spine on distal third near base of fixed finger; dorsal border with row of 9 spines; mesial surface provided in addition with 3 longitudinal rows of 8, 4, 3 spines respectively from upper to lower, and subdistal spine near articulation with dactylus; fixed finger about half as long as dactylus, unarmed. Dactylus slightly over half

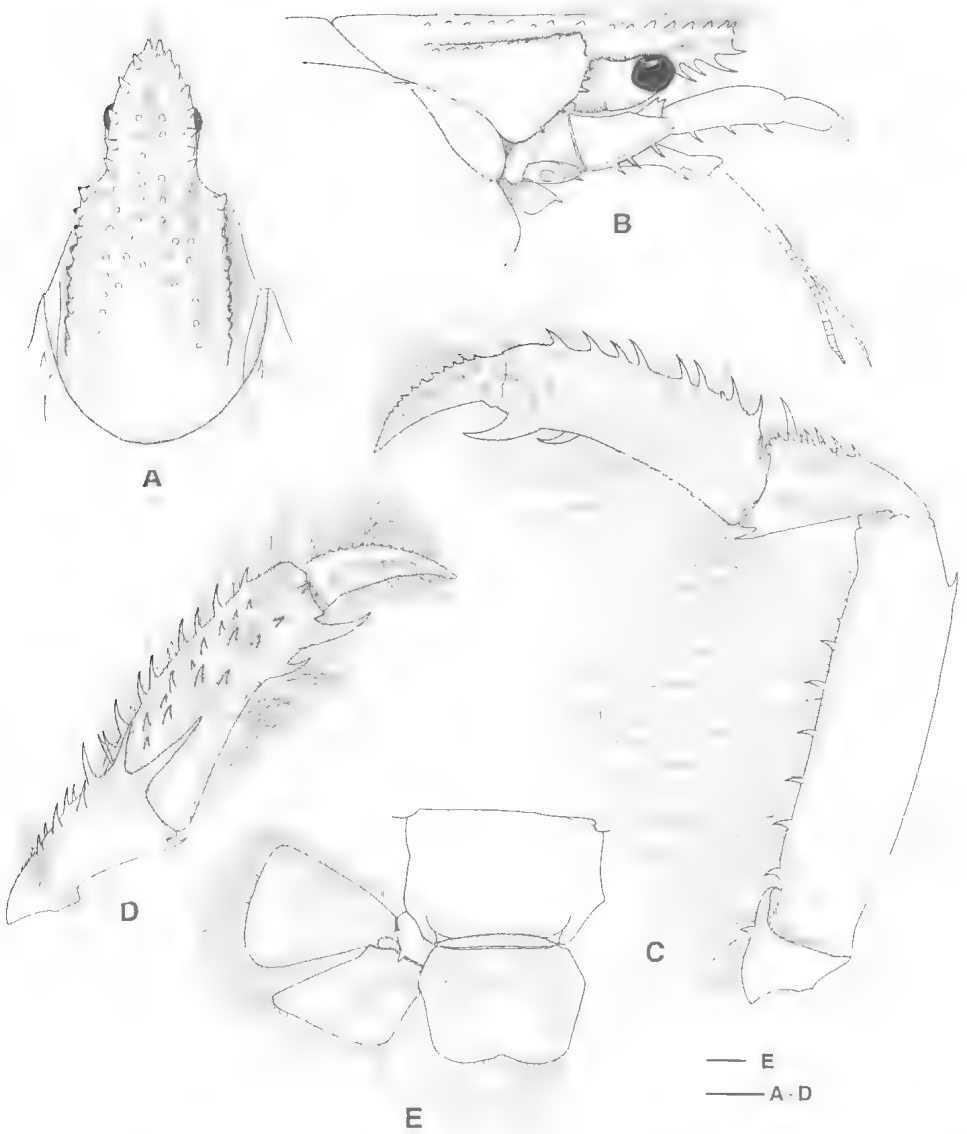

FIG. 3. *Gebiacantha lifuensis* sp. nov., holotype, ovig. female, MNHNTh1257. A,B, anterior part of carapace, dorsal and lateral view; C, pereopod 1, external view; D, distal part of pereopod 1, mesial view; E, telson and uropod. Scale line: 1mm.

as long as propodus with small tubercles on dorsal border, cutting edge unarmed.

Uropod. Exopod a little longer than telson, posterior border almost straight, meeting nearly at right angle with external lateral border; endopod approximately trapezoidal; protopod with spinule.

TYPE LOCALITY

New Caledonia (Loyalty Islands), 6-10m.

TABLE 1. Differentiating characters between *G. acanthochela* Sakai, *G. multispinosa* sp.nov. and *G. lifuensis* sp.nov.

	G. acanthochella	*G. multispinosa*	*G. lifuensis*
Rostrum	oval	triangular	oval
Infrarostral spines	2-3, small	3, large	4, large
Spines on antero-lateral region of carapace	absent	2-4	absent
Spinules on atnero-lateral border of carapace	7	6	5
Spines on lateral shouler of cervical groove	1	5	1
Peduncle of a2:			
-spinules on 2nd article	2-3	1	absent
-ventral spines on 3rd article	2	3	3
Pereopod 1 propod:			
-ext. spines btn base of fixed finger & dactyl	absent	1	absent
-mesial spines	4 rows, 9-12 spines each	6 rows, 7-12 spines each	4 rows, 3-9 spines each
-cutting edge of fixed finger	narmed	2 teeth	narmed
Pereopod 1 dactylus:			
-cutting edge	convex	convex	straight
-upper border	3 proximal tubercles	tubercles along whole length	tubercles along whole length
Telson	Slightly broader than long	1.5 times as broad as long	1.5 times as broad as long

REMARKS

This species is closely related to *G. multispinosa* captured at the same locality. It differs from the latter by: 1, shape of rostrum; 2, anterolateral region of carapace unarmed; 3, presence of single spine only on each lateral shoulder of cervical groove; 4, absence of small external distal spine on pereopod 1, between base of fixed finger and dactylus; 5, mesial surface of pereopod 1 with fewer spines; 6, fixed finger of pereopod 1 unarmed; 7, no tooth on cutting edge of pereopod 1 dactylus.

Both *G. multispinosa* and *G. lifuensis* are similar to *G. acanthochela* (Sakai) from Japan in the length and shape of their uropods, the slight median concavity of their telson, the numerous mesial spines on pereopod 1 propod. Their differences are listed in Table 1.

Upogebia Leach, 1814.
Upogebia narutensis Sakai, 1986
(Figs 4; 5A-D)

Upogebia spinifrons (Haswell, 1882): Sakai, 1984: 209, figs 1-3.
Upogebia narutensis Sakai, 1986: 25, pl. 1.

MATERIAL EXAMINED

HOLOTYPE: Naruto, Japan, M. Shimoizumi coll., date unknown: ♂, cl. 26mm, tl. 96mm (NNML36777).

OTHER MATERIAL: Peng-Hu Island (West of Taiwan), T-Y. Chan coll., 1 October 1992: 1 ♂, cl. 19.5mm, tl. 60mm (MNHNTh1258); 1 ♂, cl. 19mm, tl. 59mm, 1 ♀, cl. 18mm, tl. 58mm (MNHNTh1259); 1 ♂, cl. 19mm, tl. 58mm, 1 ♀, cl. 18mm, tl. 57mm (MNHNTh1260); 2 ♂, cl. 18mm and 19mm, tl. 52mm and 58mm; 2 ♀, cl. 17mm and 17.5mm, tl. 52mm and 53.5mm (NTOU).

DESCRIPTION

Rostrum egg-shaped, projecting far beyond eye, with 1-3 small proximal tubercles on either lateral margin and the rest unarmed; 5 small ventral spines. Deep medio-dorsal groove on rostrum and anterior part of gastric region. Few small tubercles on gastric region most of them alongside moderately broad lateral groove. Lateral ridge divided by weak mid-dorsal notch: anterior half very setose dorsally with proximal tubercle and 2 spines at tip; posterior half with 3-4 spiniform or tuberculiform teeth. Anterolateral border of carapace bearing 4 spines. Linea thalassinica distinct. Cervical groove deep and continuous, shoulders lateral to it armed with

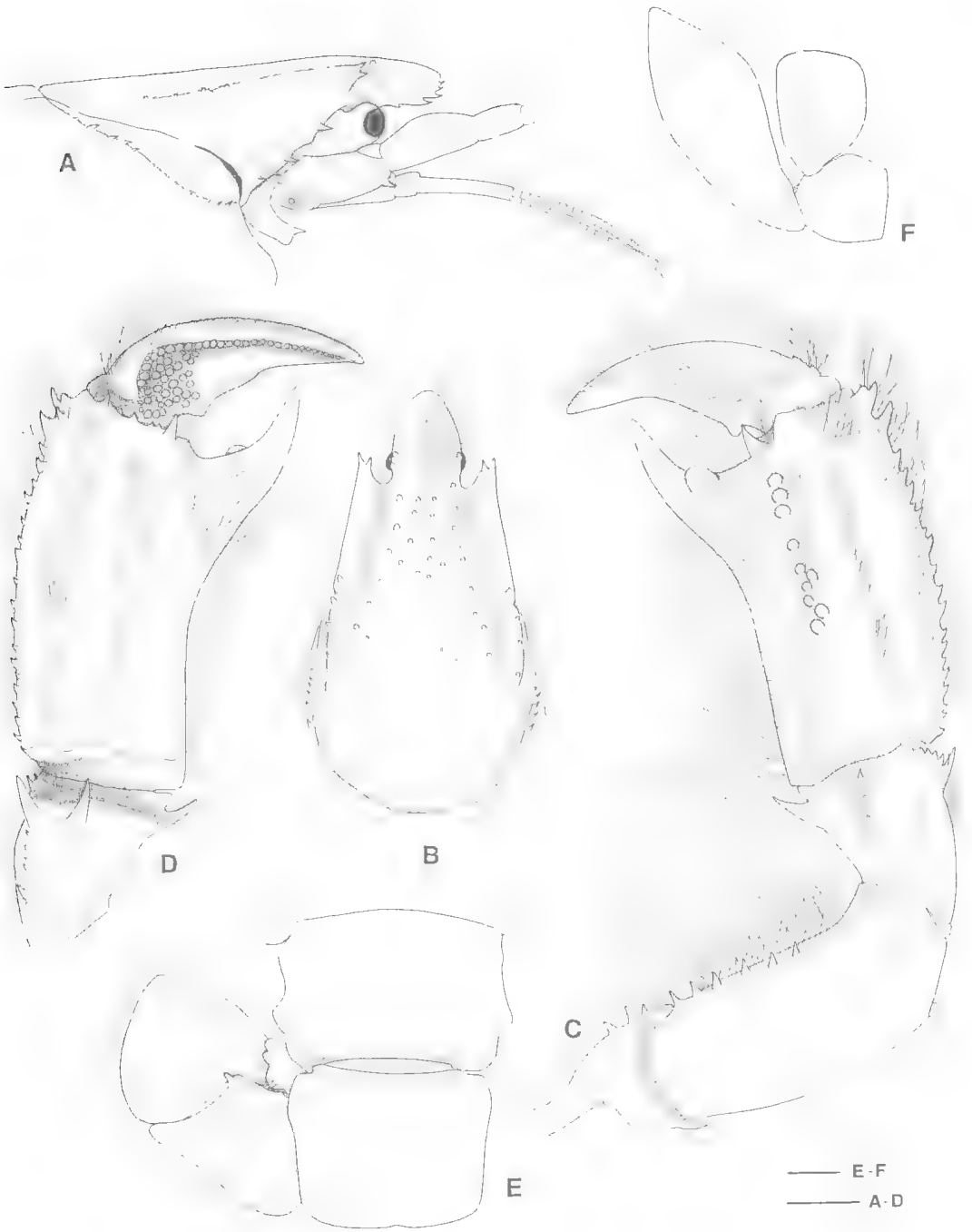

FIG. 4. *Upogebia narutensis* Sakai, male, MNHNTh1258. A,B, anterior part of carapace, lateral and dorsal view; C, pereopod 1, external view; D, distal part of pereopod 1, mesial view; E, telson and uropod; F, pleopod 2. Scale line: 2mm.

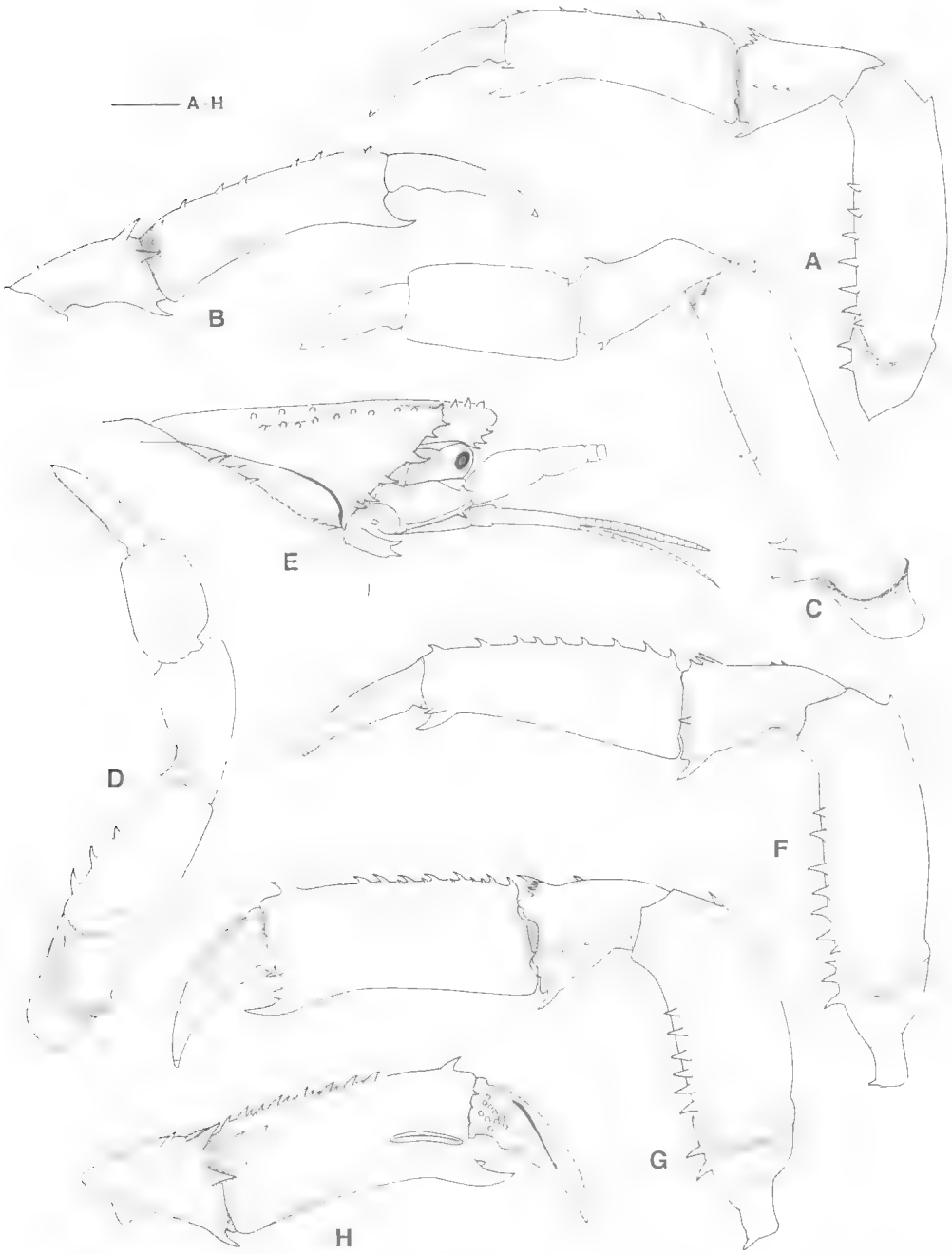

FIG. 5. A-D, *Upogebia narutensis* Sakai. A,B, female; C,D, male, MNHNTh1258, MNHNTh1259; E-H, *Upogebia wuhsienweni* Sakai. E,G,H, male; F, female, MNHNTh1265. A,F,G, pereopod 1, external view; B, H, distal part of pereopod 1, mesial view; C,D, pereopods 2 and 3 respectively; E, anterior part of carapace, lateral view. Scale line: 2mm.

spinules and tubercles. Arthrobranchs with a series of large lamellae on either side of rachis.

Telson approximately 1.3 times as broad as long, posterior margin slightly convex, very faint inverted U-shaped carina dorsally.

Antennule (Fig. 4A). Peduncle unarmed.

Antenna (Fig. 4A). Third peduncular article with small ventral subdistal spine, scale terminating in blunt tip.

Mandible. Without mesio-anterior tooth.

Maxillipeds. 1 and 3 both with epipod.

Pereopod 1. Subcheliform, sexually dimorphic, much stouter in males. Ischium with 2-3 ventral spines. Merus with dorsal subdistal spine and 5-7 ventral spines. Carpus with large ventral spine; lower half of outer surface with longitudinal crest of more or less conspicuous spinules terminating with largest one; upper half with fine longitudinal groove; carpal dorsal margin carrying 5-6 spines or spinules, and large dorsal subdistal spine at tip; 3-4 dorsal subdistal spinules external to the latter and large distal spine on upper half of mesial surface.

In males (Fig. 4C,D), palm of propodus about 1.5 times as long as broad at mid-length, broader distally; row of 12-20 spinules on dorsal margin; outer surface with ventral longitudinal row of strong round tubercles on distal half and large acute distal spine near lower base of dactylus; mesial surface bearing spinules on distal border with large distal spine near lower base of dactylus; fixed finger distal, nearly two-thirds as long as dactylus, cutting edge bearing large round tooth on external surface. Dactylus two-thirds as long as propodus with 2 proximal tubercles on dorsal border and shallow longitudinal dorsal groove on external surface; mesial surface with curved tuberculate dorsal crest and proximal round tubercles underneath; cutting edge with large proximal tooth and corneous tip.

In females (Fig. 5A,B), palm of propodus approximately 3.5 times as long as broad at mid-length and about as broad proximally as distally, unarmed except for row of 7 spinules on dorsal margin and external ventral distal spine between base of dactylus and fixed finger; fixed finger about one-fourth as long as dactylus, unarmed. Dactylus with corneous tip and shallow longitudinal dorsal groove on external surface, cutting edge with 2 minute flat teeth.

Pereopod 2. Merus with dorsal distal spine and 4-5 ventral spines, the 2 proximal of which are large. Carpus bearing ventral and dorsal subdistal spine.

Pereopod 3. Merus carrying 3 ventral spines and 1 or 2 transversal proximal rows of short setae.

Males with genital openings on coxae of both P3 and P5. Females with genital opening on coxa of P3.

Pleopod 2-5 (Fig. 4F). Endopod approximately quadrate with weak longitudinal carina.

Uropod. Latero-external and posterior margin of exopod, both slightly convex, meeting nearly at a right angle exteriorly. Latero-external margin of endopod with proximal shoulder terminating in large blunt tooth. Protopod with spinule hanging over base of endopod.

Distribution

Naruto (Japan), Taiwan.

Remarks

This material fits very well with the description and figures given by Sakai (1984, 1986) and also with the holotype examined, except for the mesial proximal tubercles of P1 dactylus that are more prominent and numerous.

The holotype of *U. narutensis* was once assigned to *U. spinifrons* (Haswell) (Sakai, 1984). Differences between the two were given by Sakai (1986). *U. narutensis* is also very similar to *U. edulis* Ngoc-Ho & Chan, 1992 as well as to *U. wuhsienweni* Yu, 1931, all three reported from Taiwan. They all have the endopod of pleopods 2-5 in an unusual quadrate shape (Fig. 4F) which may exist in other species but have been overlooked by authors; it was not reported in the original description of *U. edulis* (Ngoc-Ho & Chan, 1992).

U. narutensis resembles *U. edulis* by the unarmed anterior part of the gastric ridges, the stoutness of the male pereopod 1 and the large tooth on the cutting edge of the dactylus. It is similar to *U. wuhsienweni* in the shape of the rostrum, in the male pereopod 1 bearing a large round tooth on the cutting edge of the distal fixed finger. It differs from both *U. edulis* and *U. wuhsienweni* by the following features: 1, anterior half of the rostrum unarmed; 2, absence of a stridulating ridge on the propodus of the male pereopod 1; 3, latero-external margin of the uropod endopod with a large blunt tooth on the proximal shoulder.

In these three species of *Upogebia*, female pereopods 1 are hardly distinguishable. That of *U. narutensis* can be differentiated by the shape of its propod which is as broad distally as proximally while it is narrower distally in *U. edulis* and *U. wuhsienweni*.

Upogebia wuhsienweni Yu, 1931
(Fig. 5E-H)

Upogebia Wuhsienweni Yu, 1931: 89, fig. 2.
Upogebia wuhsienweni: Liu, 1955: 68, figs 7-12; Ngoc-Ho & Chan, 1992: 38, fig. 4; not Sakai, 1993: 92, figs 1, 2 (= *U. edulis* Ngoc-Ho & Chan).
Upogebia (Upogebia) wuhsienweni: Sakai, 1982: 59 (in part, not figs 11d, 12f-g, 13g-h, pls G1-2 and material USNM59070, 59071, 59072, 59073 (= *Upogebia edulis* Ngoc-Ho & Chan).

MATERIAL EXAMINED
How-Long, Northwestern Taiwan: 1 ♂, cl. 17mm, tl. 52mm; 1 ♀, cl. 19.5mm, tl. 60mm (MNHNTh1265).

DESCRIPTION
Rostrum rounded anteriorly, projecting beyond eyes, bearing 5-6 spiniform teeth on each lateral border, ventral surface with 3 spines. Gastric ridge divided by weak mid-dorsal notch: anterior half with 5-7 round teeth and spine at tip; posterior half with 4-5 teeth. Anterolateral border of carapace bearing 6-7 spines or spinules. Cervical groove deep, shoulders lateral to it armed with spinules and tubercles. Epistome terminating in 2 spinules. Arthrobranchs with large lamellae on either side of rachis.

Antennule (Fig.5E). Peduncle unarmed.

Antenna (Fig. 5E). Third peduncular article with small ventral subdistal spine, scale terminating in blunt tooth.

Mandible. Without mesio-anterior tooth.

Maxillipeds. 1-3 with epipod.

Pereopod 1. Subcheliform. Basis with sharp ventral spine. Ischium carrying 2-3 ventral spines. Dorsal subdistal spine and 6-7 ventral spines on merus. Carpus bearing longitudinal crest on external lower half with more or less conspicuous spinules and terminating in spine; large ventral distal spine, large dorsal distal spine along with 3-4 dorsal external spinules, large distal spine near middle of mesial surface; dorsal margin with 1-2 spines.

In males, propodus slightly broader distally than proximally with dorsal row of 8-9 spines and 8 spinules; external distal spines between base of dactylus and fixed finger; mesial surface bearing 2 proximal dorsal spines below dorsal row and slender elliptic stridulating ridge on ventral distal half; fixed finger distal, about one-third as long as dactylus, carrying large rounded external tooth near middle of cutting edge. Dactylus with corneous tip, shallow longitudinal dorsal groove on external surface; longitudinal oblique carina on mesial surface alongside fine corneous one and a few round proximal tubercles. In female, propodus narower distally than proximally with dorsal row of 9 spines, external distal spine between base of dactylus and fixed finger; fixed finger short, hardly one-fourth length of dactylus, unarmed. Dactylus with corneous tip and shallow longitudinal dorsal groove on external surface.

DISTRIBUTION
North China, Western Taiwan. This record marks a southerly range extension.

REMARKS
The present specimens from Taiwan agree closely with the material of *U. wuhsienweni* from China examined previously (Ngoc-Ho & Chan, 1992) with the following exceptions: the male pereopod 1 is more slender, being about twice as long as broad at mid-length and the female pereopod 1 carries a distal external spine between the base of the dactylus and fixed finger, that is usually missing on Chinese specimens.

U. wuhsienweni differs from *U. edulis* Ngoc-Ho & Chan by many characters (Ngoc-Ho & Chan, 1992) especially by the anterior half of its gastric ridges armed with spines, and these are clearly shown on the original figure given by Yu (1931: fig. 11A); in *U. edulis*, the same part of the gastric ridges is unarmed. All material assigned to *U. wuhsienweni* by Sakai (1982, 1993) but having an unarmed anterior half of the gastric ridges is likely to belong to *U. edulis*. Female pereopods 1 of *U. wuhsienweni* and *U. edulis* are hardly distinguishable except for a sharp spine on the basis in the former species that is replaced by a blunt tooth in the latter.

Upogebia pugnax de Man, 1905
(Fig. 6)

Upogebia (Upogebia) pugnax de Man, 1905: 600; de Man, 1928: 66, fig. 8-8e, 8f; Sakai, 1982: 52 (in part, not fig. 11b, pl E4, E6); not Sakai, 1984: 161 (= *U. fallax* de Man) and 1987: 302 (=*Upogebia sakaii* sp. nov.).
Upogebia pugnax: Ngoc-Ho, 1990: 987, fig. 7; 1991: 305, fig. 10.

MATERIAL EXAMINED
New Caledonia: Loyalty Islands (Ouvéa), J.P. Menou coll., 18.11.1991, 9-11 m: 1 ovigerous ♀, cl. 10.5mm, tl. 31.5mm (MNHNTh1261).

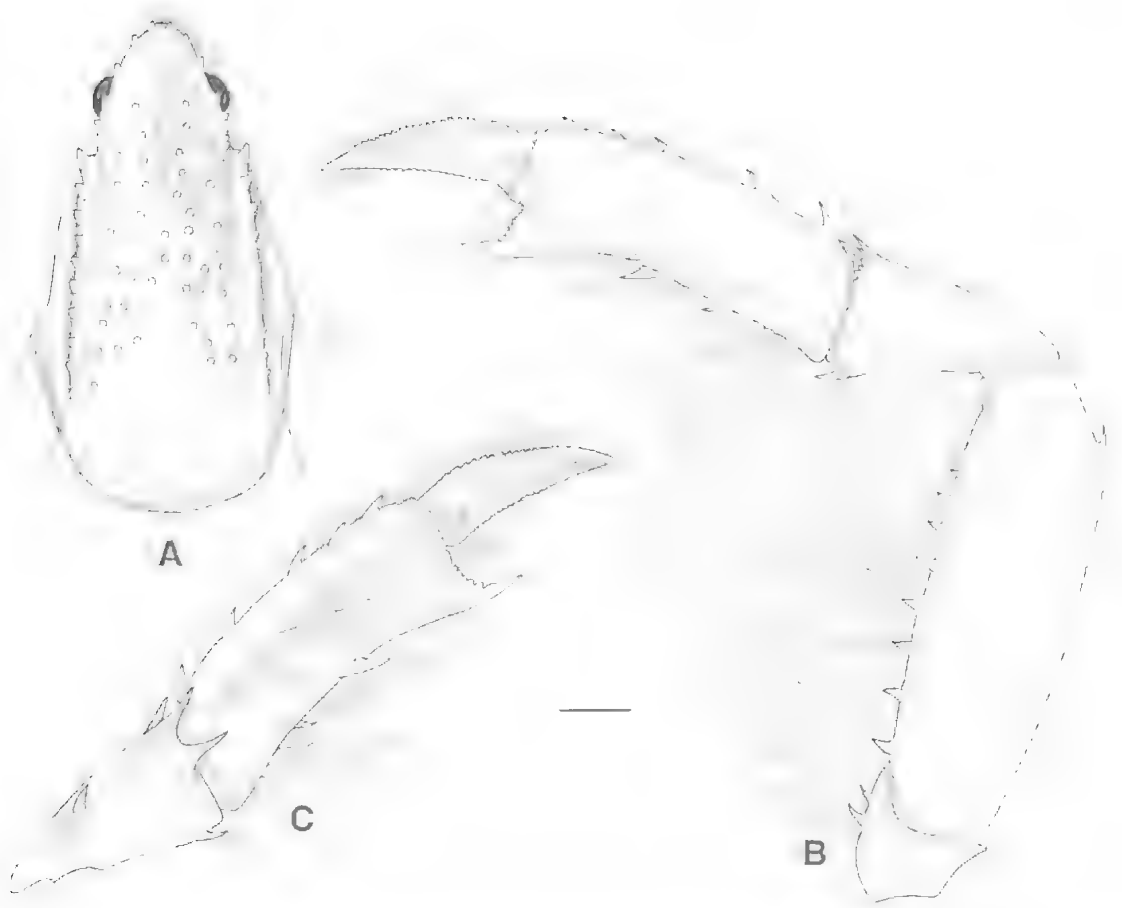

FIG. 6. *Upogebia pugnax* de Man., ovig. female, MNHNTh1261. A, anterior part of carapace, dorsal view; B, pereopod 1, external view; C, distal part of pereopod 1, mesial view. Scale line: 1mm.

DESCRIPTION

Rostrum about as long as broad at base, overreaching eyes, with 6 small teeth on either lateral border and slight median groove; proximal part of rostrum and anterior part of gastric region carrying round tubercles. Lateral groove moderately wide, lateral ridge with 10 teeth. Cervical groove deep, anterolateral border of carapace with spinule.

Pereopod 1. Subcheliform. Ischium with 2 ventral spines. Merus over 3 times as long as broad with dorsal subdistal spine and 8 ventral spines. Carpus with ventral spine and spine near middle of dorsal margin; external surface with dorsal distal spine and spinule, mesial surface with large dorsal distal spine and another near middle of distal margin. Propodus over 3 times as long as broad, carrying spine near proximal third and large spine near middle of ventral margin, with smaller one beside the latter on external surface; upper border with 5 large spines; fixed finger approximately triangular, bearing small rounded teeth on cutting edge. Dactylus about two-third as long as propodus with corneous tip, upper border and cutting edge finely denticulated, faint longitudinal groove near upper border of external surface.

Genital openings on coxae of both pereopods 3 and 5.

Pleopod 1 present.

DISTRIBUTION

Indonesia (Sumbawa), New Caledonia (St Marie Island, Loyalty Islands) (significant southerly range extension).

REMARKS

This is the first female reported for the species and it agrees well with other described material (de Man, 1928; Ngoc-Ho, 1990, 1991). It confirms that the two specimens from New Caledonia described by Ngoc-Ho (1991) are male.

With male and female adults now known, the following characteristics of *U. pugnax* can be noted: 1, Male pereopod 1 is dimorphic and can be "stout" or "slender", the latter type being very similar to that of the female. The same has been reported in *U. edulis* Ngoc-Ho & Chan (1992); 2, Males and females possess genital openings on coxae of both pereopods 3 and 5; only females possess pleopod 1; 3, The holotype (see de Man, 1928; Ngoc-Ho, 1990) is a young male of 18.5mm total length and has a "slender" type pereopod 1.

Upogebia sakaii sp. nov.
(Fig. 7)

MATERIAL EXAMINED

HOLOTYPE: Japan (Usa - Inoshiri, Kochi), K. Sakai coll., 20.5.1990, coarse sand, tidal zone: ♂, cl. 9.5mm, tl. 24.5mm (MNHNTh1262).

PARATYPES: 1 ♂, cl. 10mm tl. 22mm, 1 ♀, cl. 9mm tl. 21.5mm (MNHNTh1263); 3 ♂, cl. 9-11mm, tl. 23-28mm; 4 ♀, cl. 8.5-9.5mm, tl. 21-25mm (MNHNTh1264).

ETYMOLOGY

For Dr. K. Sakai who collected and donated this material.

DESCRIPTION

Rostrum sub-triangular, c. 1.2 times as long as broad at base, with 6 or 7 lateral spiniform teeth, slight longitudinal median groove; round tubercles on rostrum and anterior part of gastric region. Lateral groove moderately broad, lateral ridge with 9 or 10 teeth. Antero-lateral border of carapace with spinule. Cervical groove deep, linea thalassinica distinct, extending to posterior margin of carapace.

Telson slightly shorter than 6th abdominal segment, lateral border convex at proximal third, posterior border concave medially and about 2/3 as broad as proximal; very faint inverted U-shaped carina on dorsal surface.

Arthrobranchs with one series of large tubular lamellae on either side of rachis.

Antennule (Fig. 7B). First peduncular article with large ventral subdistal spine

Antenna (Fig. 7B). Third peduncular article with large ventral subdistal spine; scale not demarcated from peduncle, terminating in spinule.

Mandible. With large antero-mesial tooth.

Maxillipeds. 3 with small epipod.

Pereopod 1. Subcheliform, sexually dimorphic, stouter in males. Ischium with ventral spine. Merus 2.5 times as long as broad, bearing spine near distal quarter of dorsal margin, 7-10 ventral spines. Carpus with large ventral subdistal spine and spine near middle of dorsal margin; 3 dorsal distal (2 external, 1 mesial) spines and large spine near middle of mesial distal margin. Propodus over twice as long as broad, with 5 large dorsal spines and large ventral spine behind fixed finger; external surface with tubercles on lower third and one or 2 spinules near large ventral spine; mesial surface bearing 1-2 dorsal subdistal spines, near upper part of articulation with dactylus; fixed finger, broad and short, cutting edge with rounded teeth over proximal two-thirds, Dactylus about two-thirds length of propodus carrying faint longitudinal dorsal groove on external surface, cutting edge dentate on proximal half, with low triangular tooth near middle; tip corneous.

Female pereopod 1 with same spinulation as in males but more slender, merus and propodus about 3 and 2.5 times as long as broad respectively.

Pereopod 2. Merus with subdistal dorsal spine; 2 proximal spines on ventral border. Carpus bearing subdistal dorsal and subdistal ventral spine. Dactylus with faint longitudinal dorsal groove.

Pereopod 3. Merus with 3 ventral spines and a few tubercles on ventral margin. Subdistal ventral spine on carpus. Dactylus with comb-like setae on ventral margin.

Pereopod 4. Merus with 4-5 spiniform tubercles on ventral margin.

Males are provided with genital opening on coxae of pereopod 5, females have openings on coxae of both pereopods 3 and 5. Large coxal spine on pereopod 1, smaller ones on pereopods 2 and 3.

TYPE LOCALITY

Japan (Usa - Inoshiri, Kochi).

REMARKS

These specimens as well as others from Japan have been previously assigned to *U. pugnax* de Man (Sakai, 1982, 1987). This is probably because de Man (1928) stated that the holotype of the latter species was a female but it is actually a

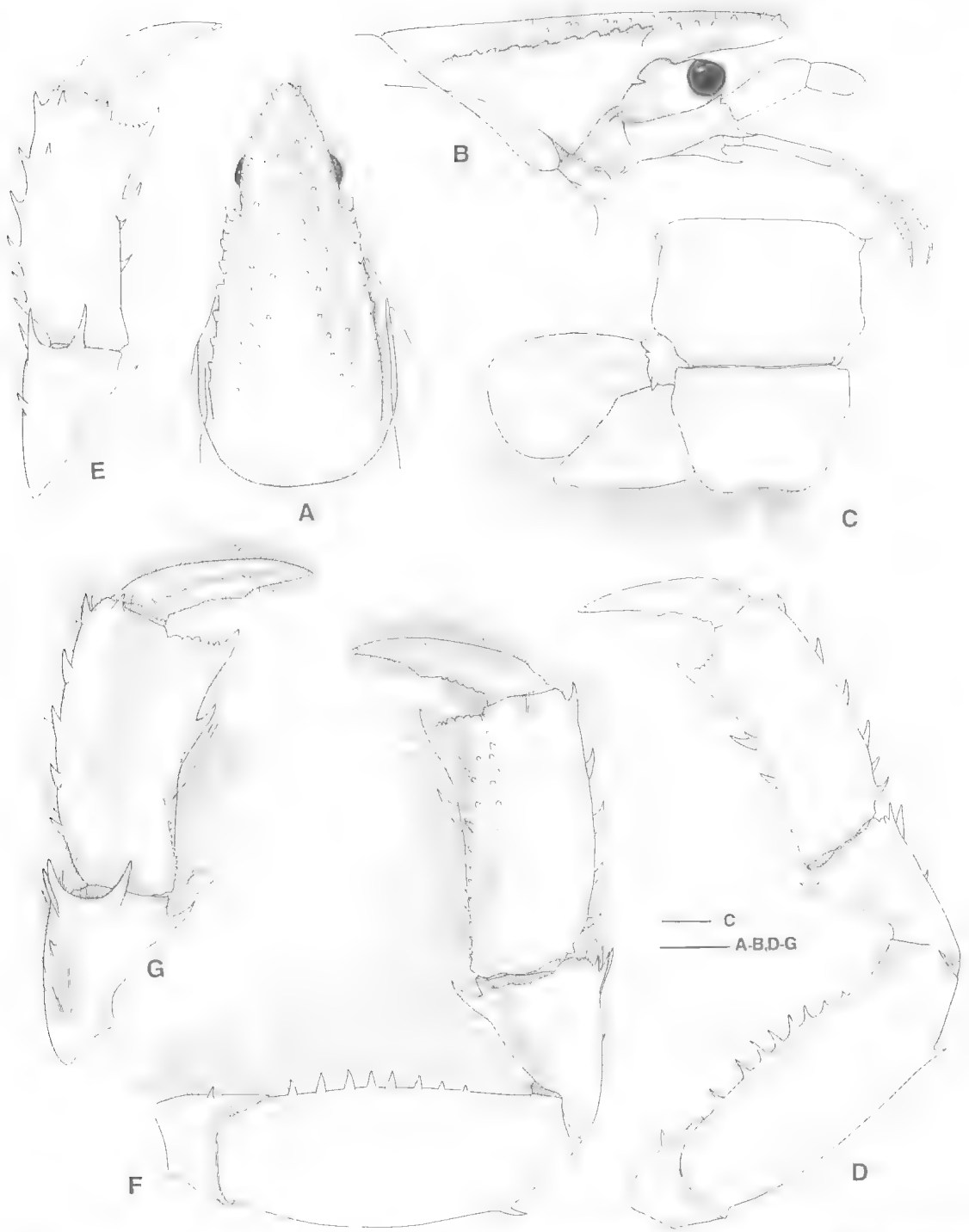

FIG. 7. *Upogebia sakaii* sp. nov. A-C, F, G, holotype, male, MNHNTh1262; D,E, female paratype, MNHNTh1263. A,B, anterior part of carapace, dorsal and lateral view; C, telson and uropod; D,F, pereopod 1, external view; E,G, distal part of pereopod 1, mesial view. Scale line: 1mm.

male. In the present new species, the females are similar to the holotype of *U. pugnax* but males differ by many features.

Two males of *U. pugnax* were described by Ngoc-Ho (1991) and an ovigerous female reported earlier in the present paper. *U. sakaii* and *U. pugnax* are very similar in the shape of the rostrum and the morphology and spinulation of all cephalic appendages. They differ by the following features: 1, epistome unarmed in *U. sakaii* but with a terminal spine in *U. pugnax*; 2, male pereopod 1 dimorphic in *U. pugnax*; 3, propod of male pereopod 1 distinctly broadened distally in *U. sakaii*; 4, in *U. sakaii*, the fixed finger of pereopod 1 is very short and the cutting edge level with the propod-dactylus articulation; in *U. pugnax*, the fixed finger is longer and the cutting edge projects beyond the propod-dactylus articulation; 5, *U. sakaii* has the dactylus of pereopod 1 with upper border unarmed or rarely denticulated proximally and with a low triangular tooth near the middle of the cutting edge; *U. pugnax* has the upper border completely denticulated and the cutting edge smooth; 6, telson with proximal border about 1.5 times broader than distal in *U. sakaii* but approximately the same in *U. pugnax*; 7, exopod of uropod with posterior margin slightly convex and postero-lateral corner rounded in *U. sakaii*; posterior margin more or less straight and meeting nearly at right angle with lateral margin in *U. pugnax*.

Upogebia savignyi (Strahl, 1862).
(Fig. 8)

Gebia sp. Savigny, 1817: pl.9, figs 3/2-2'.
Calliadne savignii Strahl, 1862: 1064.
Upogebia (Gebiopsis) rhadames Nobili, 1904: 235.
Upogebia (Calliadne) savignyi: Nobili, 1906: 98; de Man, 1927: 5, fig. 1; 1928: 47 (key).
Upogebia (Calliadne) rhadames: Nobili, 1906: 100; de Man, 1927: 6, pl.1, fig. 1; 1928: 47 (key); Sakai, 1975: 23, figs 6-8.
Upogebia (Upogebia) savignyi: Sakai,. 1982: 14.; 1984: 154.
Upogebia (Upogebia) cargadensis: Sakai, 1982: 12 (in part, material from Kenya only, ZSM 1233/1 and ZSM 1233/2).

MATERIAL EXAMINED

North Kenya Banks, "Dr. Fridtjor Nansen" Cruise N° 1, Stn. 04, 16.2.1975, 02°30'S-40°56'E, 77m, in "green sponges": 1 ♂, cl. 12mm, tl. 30mm; 4 ♀ (1 ovigerous, 1 without abdomen), cl. 11.5-13mm, tl. 29-30mm (BMNH1993: 31.5); 10 ♂, cl. 5-7.5mm; 2 ♀, cl. 5.5-7mm (syntypes of *U. rhadames* Nobili, MNHNTh45).

DESCRIPTION

Rostrum sub-triangular, as long as broad at base, overreaching eye-stalk in male, shorter in female, with 6-8 small rounded tubercles on either lateral margin. Small round tubercles on rostrum and gastric region, with 23-25 on either gastric ridge; lateral groove long and narrow. Antero-lateral border of carapace unarmed; epistome rounded distally.

Telson sub-quadrate, c. 1.5 times as long as sixth abdominal segment, posterior border and lateral posterior angles rounded, faint and fine inverted U-shaped carina on dorsal surface.

Antennule and Antenna (Fig. 8C). With unarmed peduncle; antennal scale very small.

Maxillipeds. 1 (Fig. 8F), with exopod flattened distally bearing short and long setae, longer externally; 2 (Fig. 8G) with very small upright exopod; 3 without epipod.

Pereopod 1. Cheliform. Merus about 2.5 times as long as broad, 11-13 ventral spinules. Carpus unarmed; propodus unarmed except for 7-8 small teeth on proximal half of cutting edge of fixed finger. Dactylus slightly more than half length of propodus, bearing two dorsal proximal spiniform tubercles; mesial surface with longitudinal row of small round tubercles at mid-level and large, round proximal tooth near cutting edge.

Pereopod 2. Carpus with ventral subdistal spinule.

Uropod. Exopod slightly shorter than telson; posterior margin weakly convex; lateral angle rounded; proximal spine. Endopod trapezoidal. Basipod with posterior spine.

DISTRIBUTION

Suez, Red Sea, Gulf of Aden, Persian Gulf, Kenya.

REMARKS

Examination of the present material and the syntypes of *U. rhadames* Nobili (MNHNTh45) agree with Sakai (1982) that these two species are synonymous. Also belonging to *U. savignyi* are specimens from Kenya (ZSM1233/1, 1233/2), assigned by Sakai first to *U. rhadames* (1975) and later to *U. cargadensis* Borradaile (Sakai, 1982 with selection of a neotype). This neotype selected from sample ZSM1233/2 was refuted by Ngoc-Ho (1991) as not fitting Borradaile's (1910) original description.

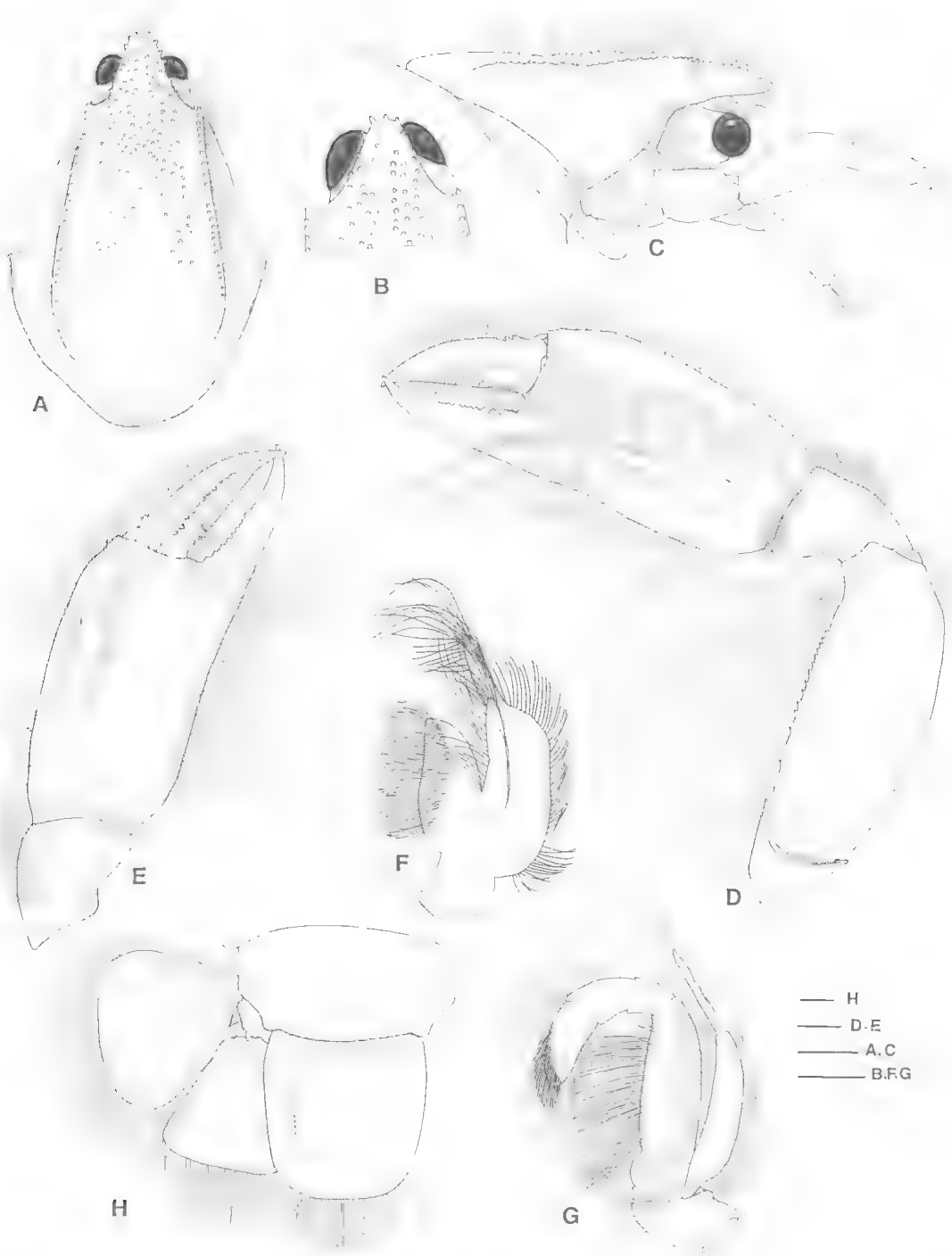

FIG. 8. *Upogebia savignyi* (Strahl). A,C-E,H, male, tl. 30mm; B,F,G, female without abdomen, cl. 13mm, BMNH1993:31.5; A-C, anterior part of carapace, dorsal and lateral view; D, pereopod 1, external view; E, distal part of pereopod 1, mesial view; F, maxilliped 1; G, maxilliped 2; H, telson and uropod. Scale line: 1mm.

There is some variation in *U. savignyi*: A, the triangular rostrum can be longer, equal, or shorter than the eye-stalk and is usually longer in males.; its tip can also be more or less pointed; B, in pereopod 1: ventral border of merus unarmed or with granules or denticles; carpus unarmed or with a ventral spinule; ventral border of propodus unarmed or with proximal denticles, dorsal border (rarely) with a distal spinule; C, posterior border of telson more or less rounded.

Diagnostic characters for the species are: 1, rostrum, gastric region and gastric ridges with numerous small tubercles; 2, linea thalassinica hardly visible posterior to cervical groove; 3, peduncle of both antennule and antenna unarmed; 4, maxilliped 1 without epipod, with exopod flattened distally, bearing setae of two lengths (Fig. 8F); maxilliped 2 with small upright epipod (Fig. 8G); maxilliped 3 without epipod; 5, Pereopod 1 cheliform; palm of propodus unarmed (with few exceptions), fixed finger with small teeth on proximal half of cutting edge; dactylus with a round mesial proximal tooth on cutting edge; 6, telson approximately quadrate, posterior border rounded; exopod of uropods with a proximal spine and basipod with a spine.

The morphology of the exopod of maxilliped 1 and the epipod of maxilliped 2 is unusual in the Upogebiidae. It has been reported in two other species: *U. tractabilis* (Hale) from Southern Australia (Ngoc-Ho, in press) and *U. stenorhynchus* Ngoc-Ho, 1991 from New Caledonia. Differences between the latter species and *U. savignyi* were given (Ngoc-Ho, 1991). Comparison of *U. savignyi* with *U. tractabilis* show certain similarities: 1, triangular shape of the rostrum; 2, peduncle of both antennule and antenna unarmed; 3, proximal spinule on exopod of uropod and another on basipod. Distinguishing characters are: 1, rostrum and gastric ridges bearing tubercles in *savignyi* but spinules or spiniform tubercles in *tractabilis*; 2, pereopod 1: merus unarmed or with a few spinules in *savignyi*, with spines in *tractabilis*; carpus unarmed in *savignyi*, with a ventro-distal spine in *tractabilis*; fixed finger cutting edge with small proximal teeth in *savignyi*, unarmed in *tractabilis*; dactylus with a proximal rounded tooth on cutting edge in *savignyi* but with 3-4 teeth medially in *tractabilis*; 3, telson with posterior border rounded in adults *savignyi*, with straight posterior border in adults *tractabilis*

Upogebia spinimanus sp. nov.
(Fig. 9)

TYPE MATERIAL

HOLOTYPE: Madagascar (Bombétoké Bay), Bastard coll.(no date): 1 ♂, cl. 5.5mm, tl. 14mm (MNHNTh790).

ETYMOLOGY

Referring to the large dorsal spine on the palm of pereopod 1.

DESCRIPTION

Rostrum sub-oval, projecting far beyond eyes; 6 small rounded teeth on either lateral margin; faint longitudinal median groove. Rounded tubercles postero-dorsally on rostrum, and on gastric region alongside lateral groove; lateral groove moderately broad. Gastric ridge with 10-12 small spiniform tubercles. Antero-lateral border of carapace with spinule. Cervical groove deep, bearing spine on either side near intersection with linea thalassinica, the latter extending to posterior margin of carapace. Epistome terminates dorsally in minute spinule.

Telson slightly broader than long, lateral border convex, postero-lateral angles rounded, posterior border nearly straight; very faint and small inverted U-shaped carina on dorsal surface.

Single pleurobranch on 5th thoracic segment in addition to arthrobranchs on maxilliped 3 and pereopods 1-4. Arthrobranchs with 2 tubular lamellae on either side of the rachis.

Antennule (Fig. 9B). First peduncular article with ventral distal spinule.

Antenna (Fig. 9B). Third peduncular article with ventral distal spinule; scale terminating in small flap extending to base of fourth article.

Maxillipeds. 1-3 with epipod, that of maxilliped 1 very small.

Pereopod 1. Subcheliform. Ischium with ventral spine. Merus about 3 times as long as broad, bearing dorsal subdistal spine and 3-4 ventral spines. Carpus with ventral distal spine, fine longitudinal groove on upper part of external surface; mesial surface with dorsal distal spine and spine near middle of distal margin. Propodus over 2.5 times as long as broad, carrying large spine near distal third of dorsal margin; fixed finger slender, about 1/3 as long as dactylus, cutting edge denticulated. Dactylus approximately 2/3 as long as propodus, with small corneous tip, unarmed.

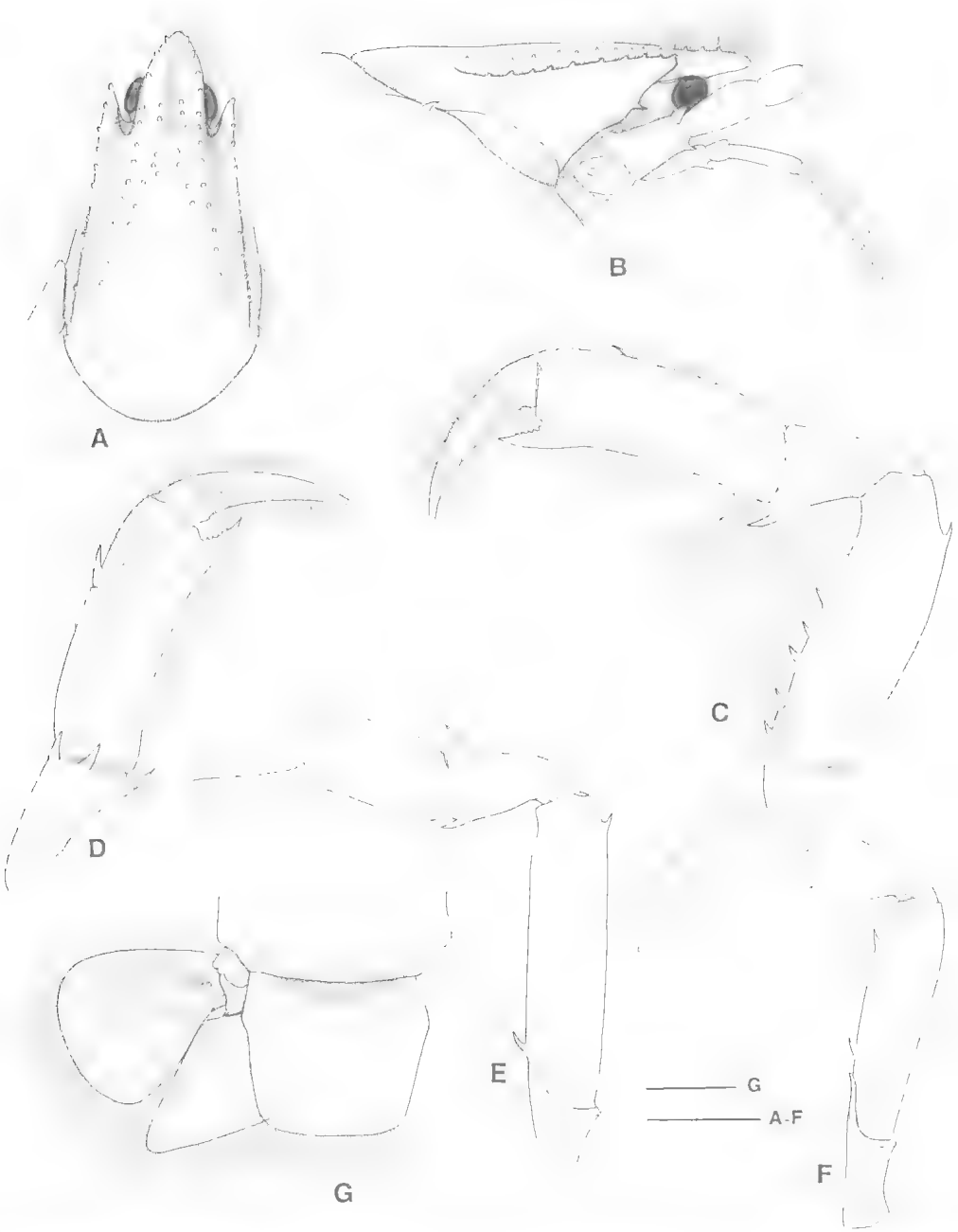

FIG. 9. *Upogebia spinimanus* sp. nov., holotype, male, MNHNTh790. A,B, anterior part of carapace, dorsal and lateral view; C, pereopod 1, external view; D, distal part of pereopod 1, mesial view; E,F, pereopods 2 and 3 respectively; G, telson and uropod. Scale line: 1mm.

Pereopod 2. Merus with dorsal subdistal, and ventral proximal spine. Carpus bearing dorsal, and ventral subdistal spine.

Pereopod 3. Merus with 2 spines on ventral margin.

Uropod. Exopod hardly longer than telson, posterior border and lateral external angle

rounded, with spinule proximally; endopod approximately trapezoidal, protopod with spinule.

TYPE LOCALITY

Madagascar (Bombétoké Bay).

REMARKS

The possession of a pleurobranch on the 5th thoracic segment places *U. spinimanus* sp. nov. within a special group of *Upogebia* which is dealt with in detail in another work (Ngoc-Ho, in press). Included are: *U. africana* (Ortmann, 1894); *U. allobranchus* Ngoc-Ho, 1991; *U. capensis* (Krauss, 1843); *U. giralia* Poore & Griffin, 1979; *U. lenzrichtersi* Sakai, 1982; *U. stellata* (Montagu, 1808).

U. spinimanus is most similar to *U. lenzrichtersi* also from Madagascar, and was compared with paratypes of the latter species in the Paris Museum (MNHNTh519, 520). The two have similar rostrums, telsons and uropods; both have a dorsal spine on the propodus of pereopod 1; both have coxal spines on pereopods 1-3. They can be separated by: 1, lateral shoulder of cervical groove with spine near intersection with linea thalassinica in *U. spinimanus* (spine absent in *U. lenzrichtersi*); 2, antennular and antennal peduncle with a ventral spine on first and third article in *U. spinimanus* (unarmed in *U. lenzrichtersi*); 3, male pereopod 1: *U. spinimanus*: merus with 3-4 ventral spines; propodus without dorsal carina behind dorsal spine, ventral margin unarmed; dactylus unarmed (*U. lenzrichtersi*: merus unarmed ventrally, or with tubercles; propodus with dorsal carina on proximal two-thirds and large mesial ventral spine near base of fixed finger; dactylus with dorsal tubercles and small round teeth on cuting edge); 4, pereopods 2 and 3 with 1-2 ventral spines in *U. spinimanus* but unarmed ventrally in *U. lenzrichtersi*.

Wolffogebia Sakai, 1982

REMARKS

Wolffogebia Sakai, 1982 was established for 4 species: *W. phuketensis* Sakai, 1982 (type species); *W. inermis* Sakai, 1982; *W. obtifrons* Sakai, 1982; and *Gebicula exigua* Alcock, 1901. Sakai gave the following diagnosis: "Dorsal surface of anterior region with a median carina. Lateral frontal process of carapace developed. Lateral longitudinal groove definable. Antero-lateral margin of carapace armed or unarmed. First pereopod subchelate."

It is questionable whether *Gebicula exigua* (also the type species of *Gebicula* Alcock, 1901) really belongs to *Wolffogebia*. This species was considered by Sakai (1982) to be a senior synonym of *Upogebia monoceros* de Man but his action was thought doubtful by Ngoc-Ho (1989) who assigned *U. monoceros* to the genus *Gebiacantha*. The holotype (a female of 15mm in total length), and only existing specimen of *Gebicula exigua*, is deposited in the Indian Museum and unavailable for examination at present. The original figure in Alcock (1901) is in lateral view and the dorsal surface of the rostrum and anterior region of the carapace are not shown. It is impossible to confirm whether the specimen possesses the first three characters given by Sakai (1982) in the diagnosis of *Wolffogebia*. However, the figure shows the antero-lateral margin of the carapace bearing at least 2 spines, which is in contradiction with the type-species of *Wolffogebia*, *W. phuketensis*, which has this border unarmed (Sakai, 1982: fig. 18c). The two characters "unarmed antero-lateral border of the carapace" together with "p1 subcheliform" displayed by *W. phuketensis* are uncommon in the Upogebiidae. Until the holotype of *Gebicula exigua* can be examined, it is not possible to know whether this deep-sea species (captured at 485m depth) belongs to *Wolffogebia*. If it does, *Wolffogebia* would become a junior synonym of *Gebicula*. *Wolffogebia* and *Gebicula* are here provisionally retained as separated genera pending a future study of *Gebicula exigua*.

Characters given as diagnostic of *Wolffogebia* by Sakai (1982), are cited above. Those relating to the lateral frontal process of the carapace, the lateral longitudinal groove and the antero-lateral margin of the carapace are not precise enough to be useful as they belong to the great majority of upogebids, and roughly half of them actually possess a subchelate pereopod 1.

Wolffogebia species form a distinctive group within the Upogebiidae. Examination of the type species, as well as *W. inermis* reveals a number of morphological features which help to better define it. They are: absence of a median longitudinal groove on rostrum; dorsal surface of anterior region with a slight median carina; antero-lateral border of carapace unarmed; arthrobranchs with a single series of large lamellae on either side of the rachis; maxilliped 1 with a large epipod; maxilliped 2 with exopod of one article, without flagellum; maxilliped 3 without epipod, exopod without flagellum; pereopod 1 subcheliform.

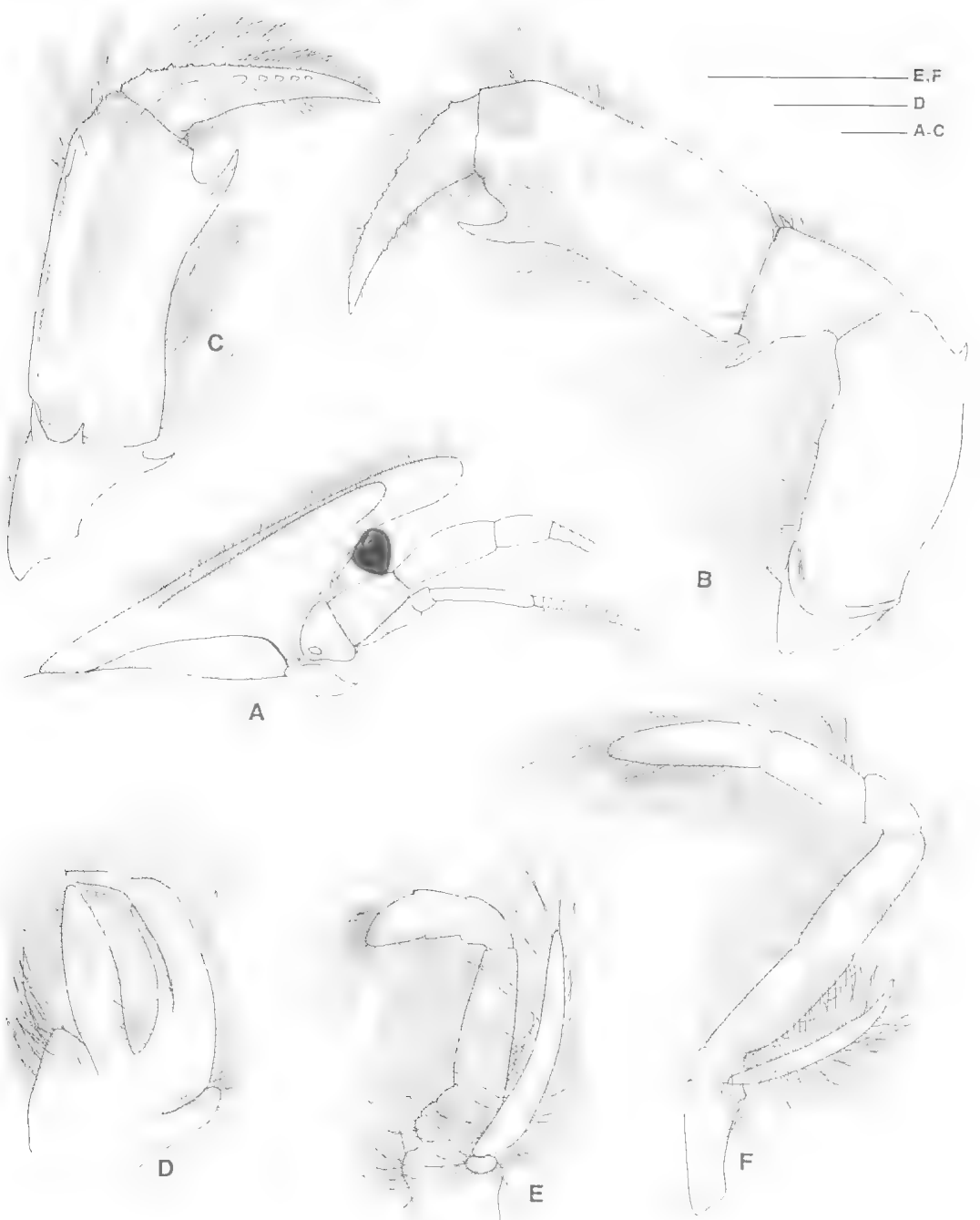

FIG. 10. *Wolffogebia inermis* Sakai. A-C, male, tl. 27mm, BMNH1993:30.2; D-F, female, tl. 27mm, MNHNTh 1279. A, anterior part of carapace, lateral view; B, pereopod 1, external view; C, distal part of pereopod 1, mesial view; D-F, maxillipeds 1, 2 and 3 respectively. Scale line: 1mm.

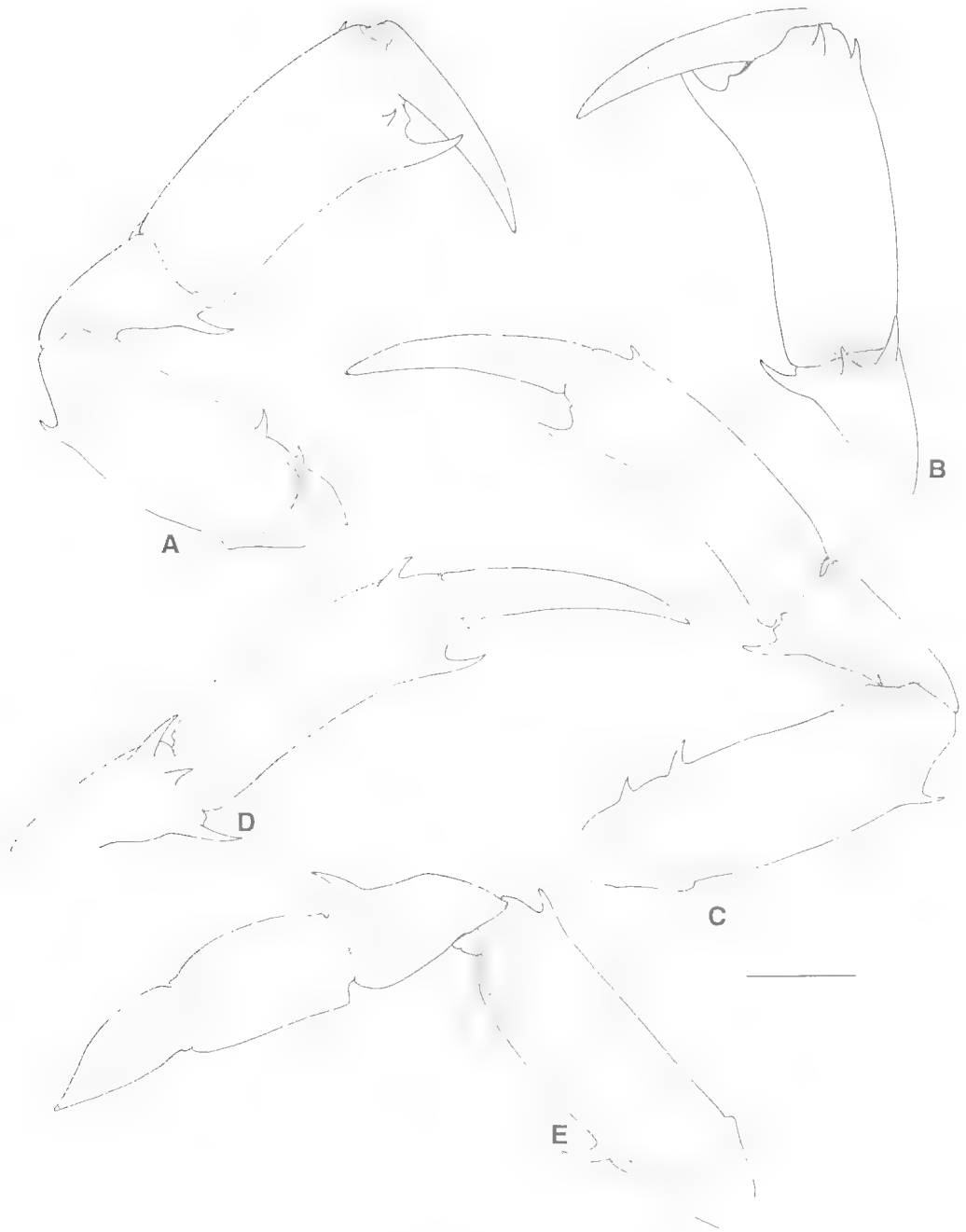

FIG. 11. *Wolffogebia inermis* Sakai. A,B, male, tl.21mm, MNHNTh1279; C-E, female, tl.27mm, MNHNTh1279. A,C, pereopod 1, external view; B,D, distal part of pereopod 1, mesial view; E, pereopod 2, external view. Scale line: 1mm.

In combination with the characters "anterolateral border of carapace unarmed" and "pereopod 1 subcheliform", the morphology of maxillipeds, especially exopods without a flagellum in maxillipeds 2 and 3, is uncommon in the Upogebiidae.

Wolffogebia inermis Sakai, 1982
(Fig. 10)

Wolffogebia inermis Sakai, 1982: 81, figs 17c, 18g, 19a-b, pl. G6; 1993: 109, figs. 12-14.

MATERIAL EXAMINED

Can-gio (Ho-chi-Minh city), Vietnam, Tran phi Hung coll., 1.5.1993, mangrove area, in mud; 5 ♂ (4 juv.), cl. 4.5-7mm, tl. 14.5-22mm, 3 ♀ (2 ovig.), cl. 7.5-8mm, tl. 27-28mm (NMHNTh1279); no locality data: 2 ♂, cl. 8mm and 11.5mm, tl. 21.5mm and 27mm; 1 ♂, 1 ♀ damaged, 1 male P1 (BMNH1993:30.2).

DESCRIPTION

Rostrum elongate, with rounded tip projecting far beyond eye, setose but unarmed, as are gastric region and gastric ridge. Lateral groove narrow; antero-lateral border of carapace unarmed. Cervical groove moderately deep, linea thalassinica faint posterior to it. Epistome terminating in spinule. Arthrobranchs with single series of large lamellae on either side of rachis.

Antennule and Antenna (Fig. 10A). Both peduncles unarmed, antennal scale minute.

Maxillipeds 1 (Fig. 10D), with large epipod; 2 (Fig. 10E), with simple exopod, without flagellum; 3 (Fig. 10F), without epipod, exopod simple in large specimens, with short indifferentiated flagellum in juveniles.

Pereopod 1. Subcheliform, sexually dimorphic. Ischium with ventral spine. Merus with dorsal subdistal, and ventral proximal spine. Carpus bearing large ventral distal spine; external surface with faint longitudinal groove on upper half; mesial surface carrying dorsal distal spine and another near middle of distal border. Propodus in males over twice as long as broad at mid-length, more slender in females; mesial surface with fine longitudinal dorsal carina in adult males, smooth in juveniles and females, all with large dorsal subdistal spine; fixed finger subdistal, unarmed. Dactylus in adult males three-quarters as long as propodus, with corneous tip and denticles on dorsal margin, external surface with 0-6 round tubercles near cutting edge, mesial surface with longitudinal row of 2-6 teeth or tubercles on upper half; dactylus unarmed in juveniles and females except for 1-3 small mesial tubercles.

Pereopod 2. Merus with dorsal subdistal and ventral proximal spine; carpus with dorsal subdistal spine.

DISTRIBUTION

Indonesia (Java, Mocara Tangerang), Vietnam (Can-gio).

REMARKS

Sakai (1982) stated that the holotype (♂, 34mm tl., from Java, Mocara, Tangerang) and sole specimen was deposited in the Zoölogisch Museum-Universität van Amsterdam, but there is no record of it there, nor in the Zoologisches Institut-Universität Hamburg (D. Platvoet & G. Hartmann, pers. comm.).

The present material agrees well with the description and figures of the holotype especially in the absence of all spines or tubercles from the carapace. Pereopod 1 is slightly more slender in this material; in adult males, the dactylus bears denticles on the dorsal margin, external tubercles near the cutting edge, and a row of 2-6 teeth or tubercles on the mesial surface. The dactylus of P1 on the holotype has both the dorsal margin and the cutting edge unarmed and only a single mesial tooth is present (Sakai, 1982: fig. 20E). Another variation concerns the right P1 of a male from Vietnam of 22mm tl. which is larger than the left and armed with an external subdistal spine near the base of the fixed finger, and a mesial subdistal spine near the base of the dactylus (Fig. 11A, B). These spines are not reported in the holotype and absent in the rest of the material examined.

Females studied also agree well with the specimen recently described by Sakai (1993: fig. 13b,c) (ovig. ♀, 30mm tl., from Darwin, Australia) except that in the Australian specimen, the exopods of both maxillipeds 2 and 3 are provided with a flagellum. It is questionable whether there was a mistake.

Wolffogebia phuketensis Sakai, 1982
(Fig. 12)

Wolffogebia phuketensis Sakai, 1982: 75, figs 17a, 18c-d, 20b

MATERIAL EXAMINED

HOLOTYPE: Phuket, Thailand, ♂, tl. 39m (UMK type collection).

OTHER MATERIAL: Northwestern Singapore, in mangrove, in burrows of *Thalassina anomala* mound.

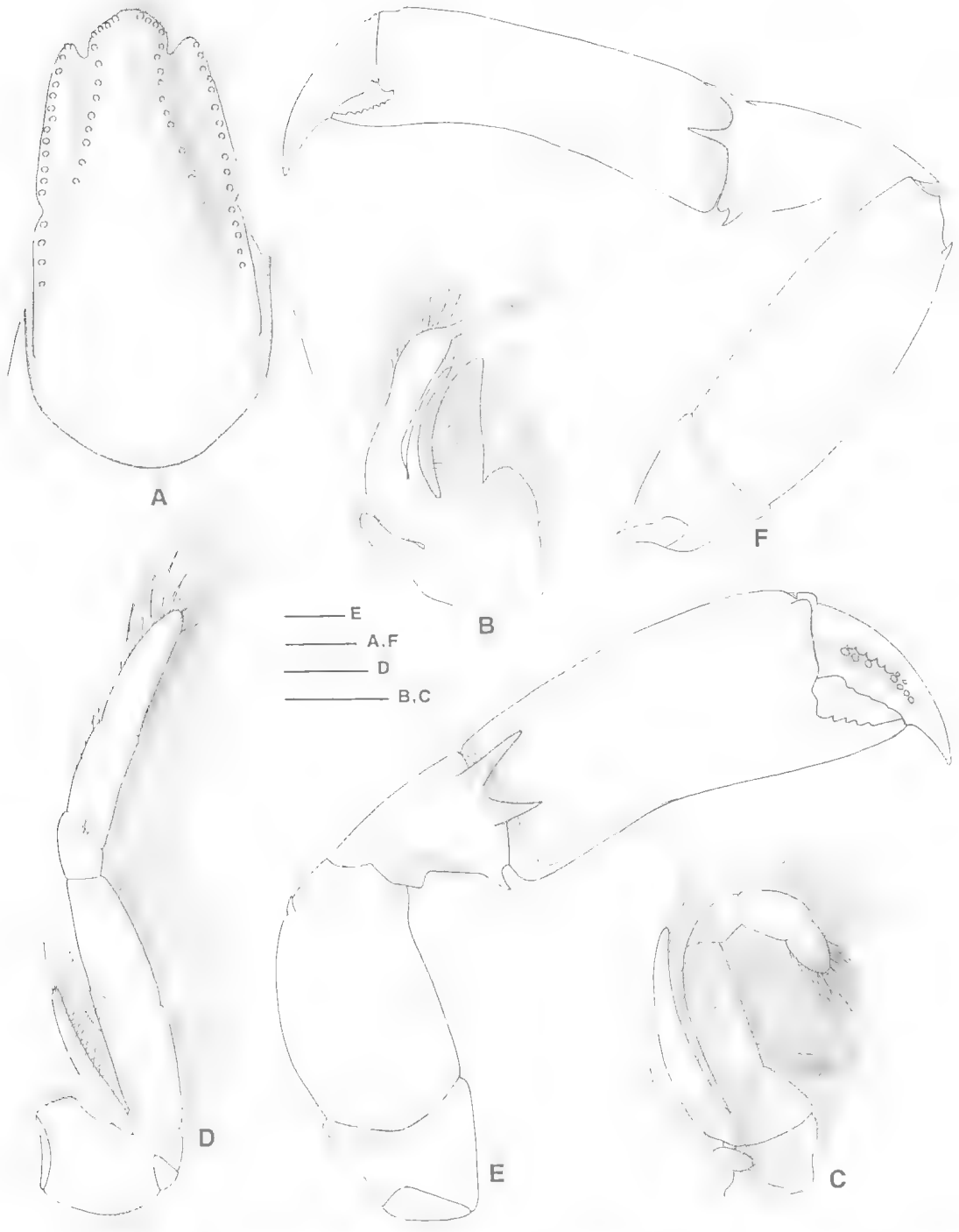

FIG. 12. *Wolffogebia phuketensis* Sakai, QMW14854. A-D, ovig. female, tl. 34mm; E, male; F, female tl. 25.5mm. A, anterior part of carapace, dorsal view; B, maxilliped 1; C, maxilliped 2; D, maxilliped 3; E,F, pereopod 1, mesial view. Scale line: 1mm.

P. Davie & P. Ng coll., 6.9.1987: 2 ♀ (1 ovig.), cl. 8.5mm and 10mm, tl. 25.5mm and 34mm; 1 ♂ without abdomen, cl. 13mm (QMW14854).

Description

Rostrum low, triangular, about half as long as wide at base in females, longer in male, projecting slightly beyond eyes, with 4 round teeth laterally; dorsal surface without median longitudinal groove, very setose. Gastric region setose laterally with 8-9 round tubercles alongside either lateral groove; medially with a non setose area the anterior part of which slightly elevated in the shape of a weak carina pointing forwards. Lateral groove moderately deep; lateral ridge with small median notch, carrying 12-13 and 4-5 round tubercles on anterior and posterior half respectively. Anterolateral border of carapace unarmed. Cervical groove deep, linea thalasinica invisible posterior to it. Arthrobranchs with single series of large lamellae on either side of the rachis.

Antennule and Antenna. Peduncle unarmed.

Mandible. Without antero-mesial tooth.

Maxillipeds. 1 (Fig. 12B) with large epipod; 2 (Fig. 12C) with single article on exopod, without flagellum; 3 (Fig. 12D) without epipod, exopod without flagellum.

Pereopod 1. Subcheliform, stouter in male than in female. Merus with dorsal subdistal spine. Carpus with a ventral subdistal, and 2 large mesio-distal spines. Propodus about twice as long as broad at mid-length in male, over 3.5 times in female, palm unarmed, fixed finger with small teeth on proximal two-thirds of cutting edge. Dactylus with weak longitudinal mesial tuberculate crest and a few tubercles in male, unarmed in female; cutting edge bearing 2-4 minute teeth.

Pereopod 2. Merus with dorsal subdistal and ventral proximal spine.

Distribution

Thailand (Phuket Island); Singapore.

Remarks

The specimens examined agree closely with Sakai's description and figures and with the holotype of *Wolffogebia phuketensis*. The exopods of both maxillipeds 2 and 3 are clearly simple (Fig. 12C,D) The external view of male pereopod 1 was given by Sakai (1982), the mesial view of the same appendage in both male and female is provided (Fig. 12E,F).

ACKNOWLEDGEMENTS

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AN ANNOTATED LIST OF RECENT ADDITIONS TO THE CETACEAN COLLECTION IN THE QUEENSLAND MUSEUM

R.A. PATERSON

Paterson, R.A. 1994 06 01: An annotated list of recent additions to the cetacean collection in the Queensland Museum. *Memoirs of the Queensland Museum* 35(1): 217-223. Brisbane. ISSN 0079-8835.

Recent additions to the cetacean collection in the Queensland Museum, including the Museum of Tropical Queensland at Townsville, represent 4 mysticete and 13 odontocete species. Two of the odontocetes, *Stenella longirostris* and *S. attenuata*, have not been previously recorded from Queensland. The collection is dominated by species which frequent or migrate to tropical and sub-tropical coastal waters. □*Cetaceans, Queensland Museum collection, recent additions.*

R.A. Paterson, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; 10 December 1993.

Important material has been added to the Queensland Museum (QM) cetacean collection in the past decade. Registration number, location, collector or donor, method of discovery, date of collection or discovery and material held as well as the order of classification follow Paterson (1986). Specimens identified by Dr Peter Arnold of the Museum's Townsville branch (the Museum of Tropical Queensland) and held there or at the Department of Zoology, James Cook University are indicated by an asterisk. Many of those specimens were obtained from animals drowned in protective shark nets set in the Townsville/Magnetic Island region.

Mysticete and odontocete larynges are illustrated here as part of a continuing study of the cetacean larynx at the QM.

Mammals registered in the QM collection are prefixed with the letters J or JM and QBFP and QDEH are acronyms for the Queensland Boating and Fisheries Patrol and Queensland Department of Environment and Heritage.

SYSTEMATICS

Suborder MYSTICETI
Family BALAENOPTERIDAE

Balaenoptera musculus Linnaeus,1758
(Blue whale)

MATERIAL

JM10415, St Lawrence (22°19'S, 149°38'E), R.A. Paterson, S. Van Dyck, and P. Cross, K. Fowler (QBFP), beachcast, 24.ii.94: skull (with the exception of nasals and premaxillae), mandible, majority of post-cranial skeleton, partial baleen.

Balaenoptera acutorostrata Lacépède,1804
(Minke whale)

MATERIAL

*JM3861, Hook Reef (19°50'S, 149°13'E), James Cook University staff, died after 'entrapment' in Hook Reef lagoon, 28.xi.82: complete skeleton and baleen; JM5434, Granite Bay, Noosa (26°23'S, 153°06'E), RAP, SVD; beachcast, 5.viii.86: complete skeleton, partial baleen; JM7301, Big Sand Hill, Moreton Is. (27°13'S, 153°23'E), RAP, P. Paterson, beachcast, 11.vi.87: complete skeleton, partial baleen; JM8513, Woralie Creek, Fraser Is. (25°08'S, 153°06'E), RAP, SVD, P. Gillespie, stranded, 16.xi.90: complete skeleton and baleen, larynx (Fig.1); JM8808, Wathumba Creek, Fraser Is. (24°59'S, 153°13'E), RAP, SVD, beachcast, 15.viii.91: skull and mandible, partial baleen; JM9029, Maroom, Great Sandy Strait (25°37'S, 152°52'E), RAP, SVD, beachcast, 26.x.91: skull and mandible, partial baleen; JM9453, Tangalooma Wrecks, Moreton Is. (27°11'S, 153°22'E), QDEH, drowned in hold of former whale chaser: mandible, partial skull, post-cranial skeleton and baleen.

REMARKS

With the exception of JM3861 the specimens were those of juvenile or recently born animals Horwood (1990) noted that most series of minke whale strandings contained a high proportion of immatures.

Best (1985) detailed the external characters of Southern Hemisphere minke whales and described a diminutive (Type 3) form. Arnold, Marsh & Heinsohn (1987) discussed the occurrence of minke whales in east Australian waters and described JM3861 in detail. It is a Type 3 specimen and they termed it a dwarf minke

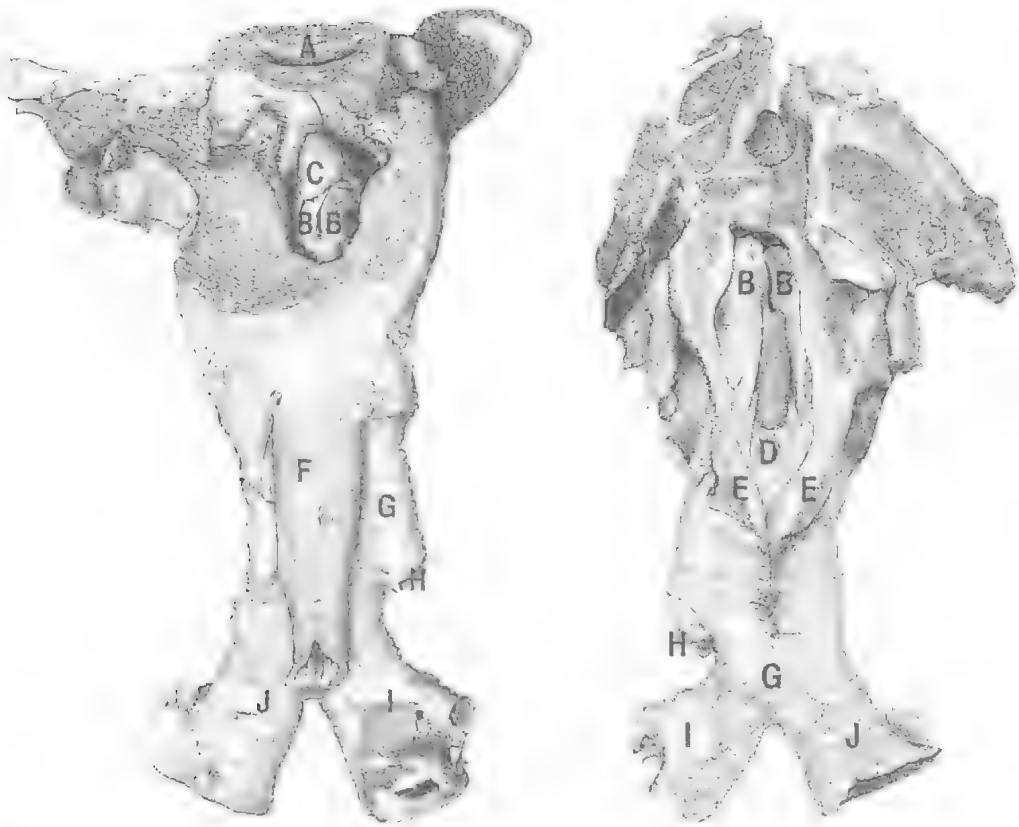

FIG. 1. *Balaenoptera acutorostrata*, JM8513. Larynx from dorsal aspect (left) and ventral aspect (right). A, pharynx; B-B paired arytenoid cartilages; C, epiglottic cartilage; D, ventral diverticulum, opened after splitting thyro- arytenoid muscle (E-E); F, oesophagus; G, trachea; H, eparterial bronchus; I, right main bronchus; J, left main bronchus.

whale. The reproductive status of JM3861 was described by Marsh (1985). The external colour patterns and cranial appearances of Type 1 and 3 specimens in the collection at Brisbane are illustrated in Figs 2,3.

Balaenoptera borealis Lesson,1828
(Sei whale)

MATERIAL

JM4918, 'Whale Beach', Tuan (25°40'S, 152° 54'E), RAP, P. Paterson, stranded in 1940s, 21.iv.84: partial basi-cranium, tympanic bulla.

REMARKS

J21713 was listed as *B. borealis* by Paterson (1986) but correctly identified as *B. edeni* (Bryde's whale) by Paterson & Van Dyck (1988).

Megaptera novaeangliae Borowski,1781
(Humpback whale)

MATERIAL

JM5252, Spitfire Creek, Moreton Is. (27°04'S, 153°27'E), V.C. Bushing, RAP, beachcast, 2.xi.84: partial skull and post-cranial skeleton. Described by Bushing (1991); JM7302, Brown's Rocks, Fraser Is. (24°47'S, 153°16'E), RAP, SVD, stranded, 3.vii.89: skull, mandible and partial post-cranial skeleton, baleen. Described by Paterson & Van Dyck (1991); JM7303, Moon Point, Fraser Is. (25°13'S, 152°59'E), V. Hislop, stranded, 17.x.89: complete skeleton, baleen and larynx. Described by Paterson & Van Dyck (1991), Quayle (1991); JM8318, Tangalooma, Moreton Is. (27°11'S, 153°22'E), D. Lovey, whaling operations: dried penis; JM8658, Eager's Creek, Moreton Is. (27°07'S, 153°27'E), B. McLarty (QDEH), RAP, SVD, stranded, 19.vii.91: skull, mandible, baleen and larynx. Described by Paterson et al. (1993).

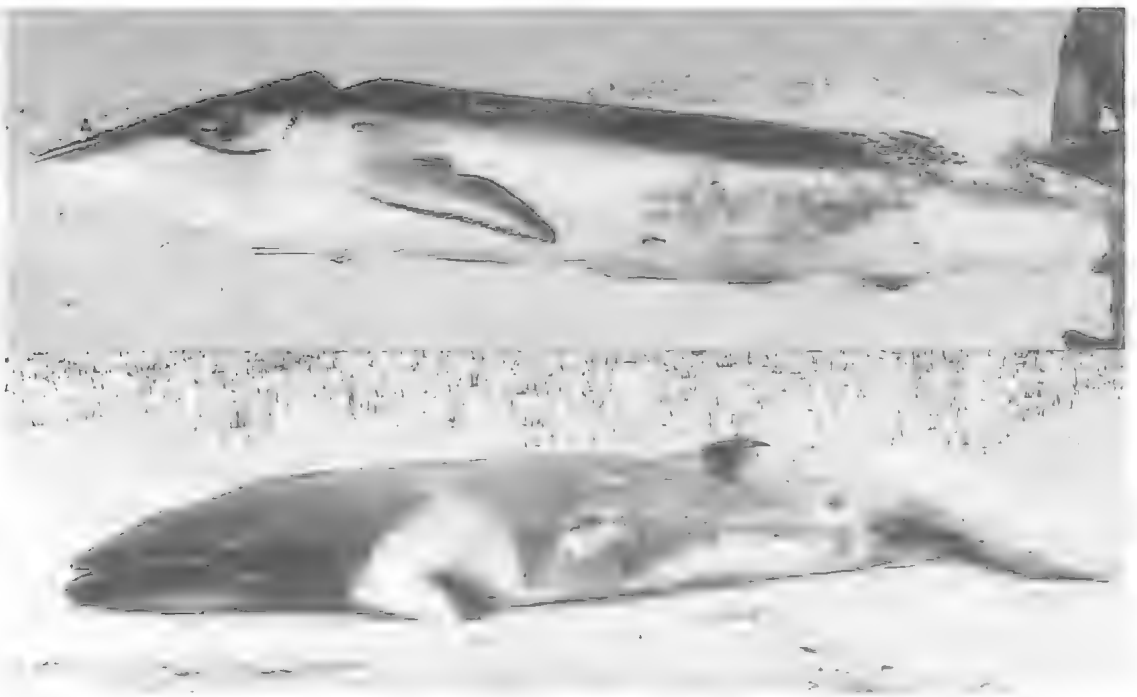

FIG. 2 *Balaenoptera acutorostrata*. Upper, JM8513, flipper and body colouration of Type 1 form; Lower, JM7301, flipper and body colouration of Type 3 form.

Suborder ODONTOCETI
Family ZIPHIIDAE

Ziphius cavirostris Cuvier,1823
(Cuvier's beaked whale)

MATERIAL
JM5264, Agnes Water (24°10'S, 151°33'E), RAP, SVD, beachcast, 30.i.86: damaged skull. Described by Paterson & Van Dyck (1990); JM7677, Cape Hillsborough (20°56'S, 149°03'E), P. Arnold, K. Saalfeld, beachcast, 8.vi.89: skull and mandible.

REMARKS
Radiographs demonstrate paired anterior mandibular teeth and numerous needle-shaped rudimentary teeth in both jaws (Fig.4).

Mesoplodon densirostris de Blainville,1817
(Dense-beaked whale)

MATERIAL
JM6460, Noosa River mouth (26°23'S, 153°06'E), SVD, beachcast, 4.vi.86: complete skeleton. Described by Paterson & Van Dyck (1990); JM8807, Point Lookout, North Stradbroke Is. (27°26'S, 153°33'E), RAP, SVD, beachcast, 22.x.91: complete skeleton and larynx; JM9640, Cathedral Beach, Fraser Is. (25°10'S, 153°13'E), J. Ford (QDEH), P. Stumkat, K. Williams, beachcast, 21.vi.92: complete skeleton and larynx.

REMARKS
JM8807 and JM9640 were described by Paterson et al. (1993).

Mesoplodon layardii Gray,1865
(Straptooth beaked whale)

MATERIAL
JM6198, Whitsunday Passage (20°20'S, 148°50'E), K. Saalfeld, R. Hughes, A. Smith, beachcast, 18.viii.86: complete skeleton. Described by Paterson & Van Dyck (1990); JM8498, Lady Elliott Is. (24°07'S, 152°43'E), D. Lee (QDEH), beachcast, 19.iv.90: skull and mandible.

Family PHYSETERIDAE

Physeter macrocephalus Linnaeus,1758
(Sperm whale)

MATERIAL
JM7307, Dundowran (25°18'S, 152°46'E), RAP, SVD, stranded, 30.iv.84: squid beaks from JM4420.

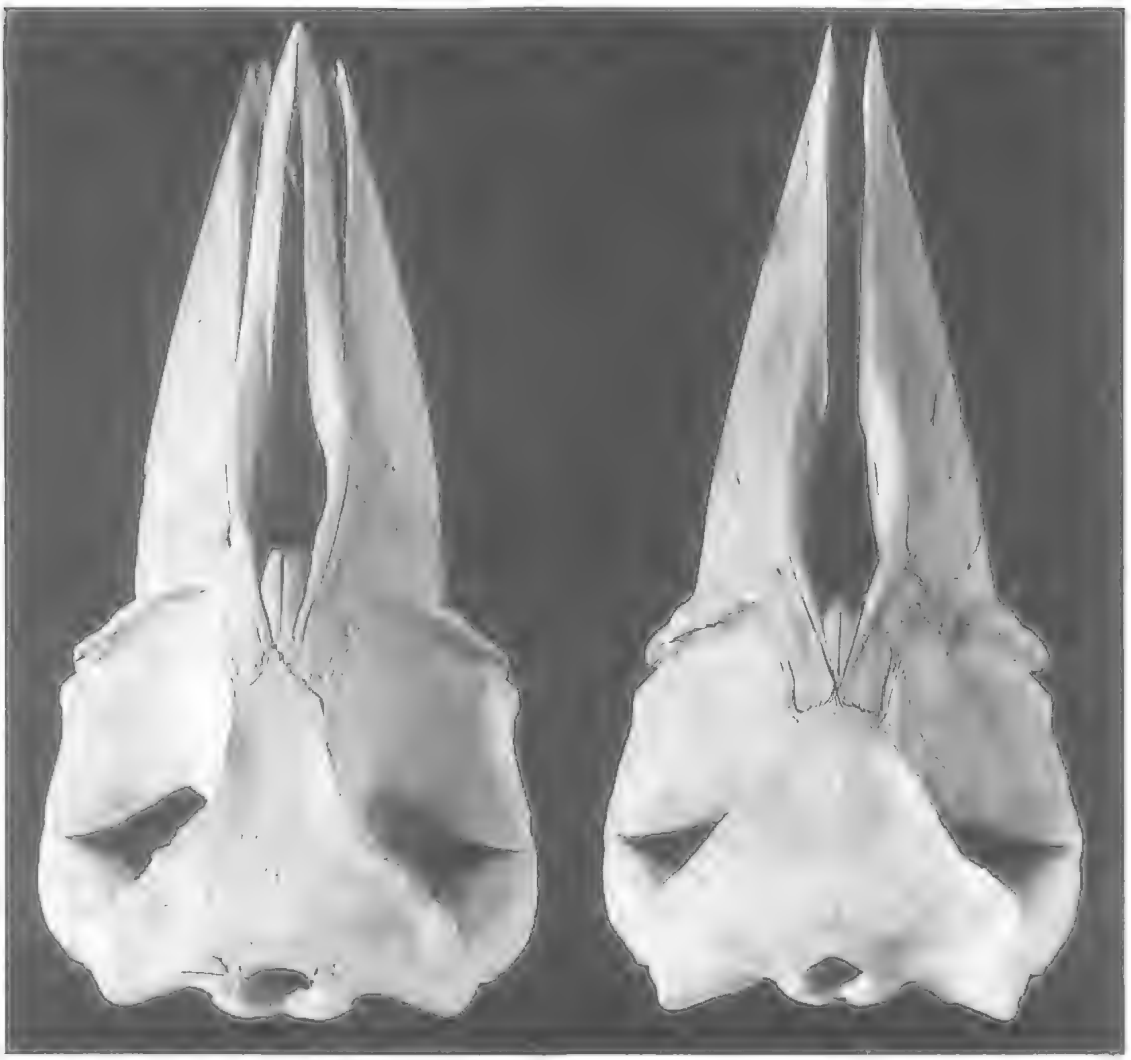

FIG. 3. *Balaenoptera acutorostrata*. Left, JM8513 (Type 1); Right, JM8808 (Type 3). Dorsal cranial structures in immature specimens.

Described by Paterson (1986); JM9920, Main Beach, North Stradbroke Is. (27°27'S, 153°32'E), RAP, SVD, G. Jaques, beachcast, 6.vii.93: skull, partial post-cranial skeleton and larynx (Fig.5).

Kogia breviceps de Blainville,1838
(Pygmy sperm whale)

MATERIAL
JM5698, Moore Park, Bundaberg (24°52'S, 152°21'E), C. Limpus (QDEH), SVD, stranded, 15.i.87: complete skeleton, reproductive tract (in spirit); JM5699 (calf of JM5698, in spirit); JM8796, Yellow Patch, Moreton Is. (27°02'S, 153°26'E), RAP, stranded, 6.vii.88: skull; JM10000, Mudjimba Beach (26°37'S, 153°06'E), QBFP, C. Cowell, beachcast, 8.ix.93: complete skeleton and viscera; JM10001 (foetus of JM10000, in spirit).

Family STENIDAE

Sousa chinensis Osbeck,1757
(Indopacific humpback dolphin)

MATERIAL
*JM4701, Picnic Bay, Magnetic Is. (19°11'S,

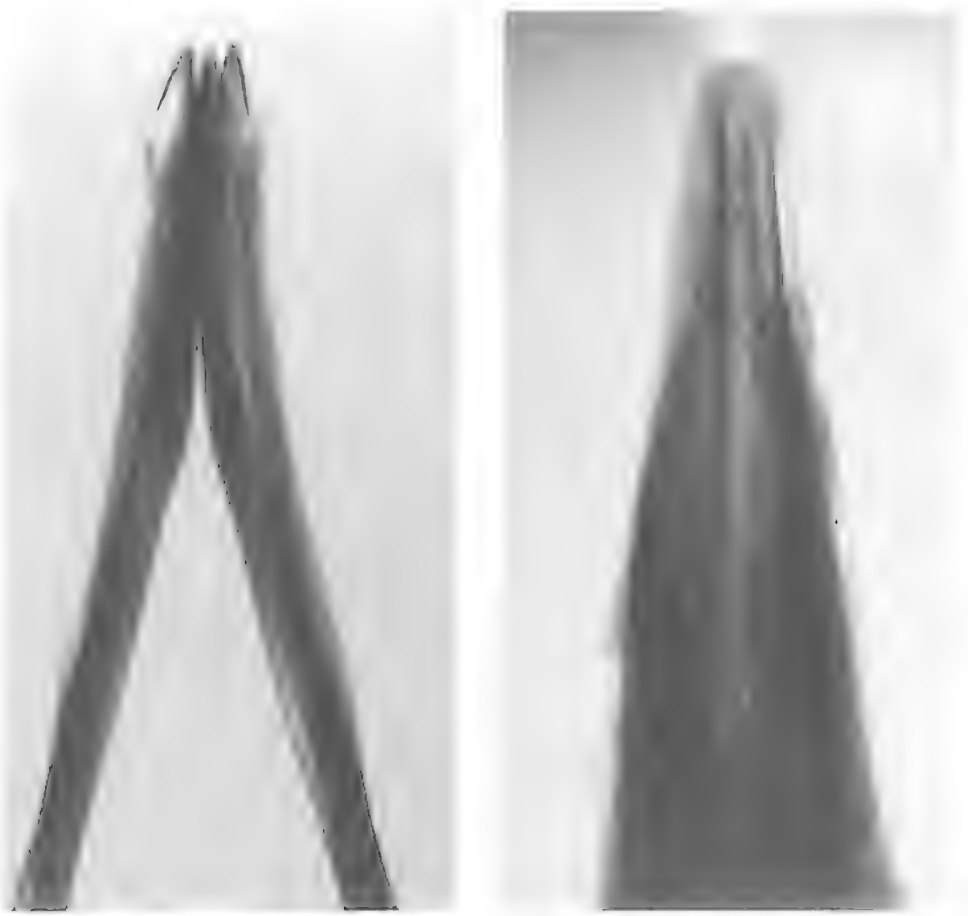

FIG. 4 *Ziphius cavirostris*, JM7677. Radiographs of mandible (left) and maxilla (right) demonstrating paired anterior mandibular teeth and numerous needle-like rudimentary teeth in both jaws of this female specimen. There were at least 34 rudimentary teeth in each jaw. Some were lost before the radiographs were taken.

146°50'E), 9.x.69; *JM4703, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 4.iii.70; *JM4710, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 4.ii.71; *JM4711, Kissing Point, Townsville (19°14'S, 146°48'E); *JM4717, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 24.x.71; *JM4728, Florence Bay, Magnetic Is. (19°07'S, 146°53'E), 16.viii.75; *JM4731, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 19.i.76; *JM4737, Rowe's Bay, Townsville (19°13'S, 146°47'E), 5.vii.78; *JM4738, Rowe's Bay, Townsville (19°13'S, 146°47'E), 30.vii.84; JM5333, Adder Rock, North Stradbroke Is. (27°26'S, 153°32'E), RAP, beachcast, 27.ix.85: skull and mandible; JM5355, M.M. Bryden: complete skeleton; JM6434, M.M. Bryden: skull; *JM7678, Rowe's Bay, Townsville (19°13'S, 146°47'E), 22.i.90; JM10416, Ayr (19°34'S, 147°24'E), Sea World Staff, stranded, 1.iii.94: juvenile (in spirit).

Family GLOBICEPHALIDAE

Globicephala macrorhyncus Gray, 1846
(Shortfin pilot whale)

MATERIAL

*JM4732, *JM4733, Conway Beach, Proserpine (20°29'S, 148°45'E), 25.i.86.

Peponocephala electra Nishiwaki & Norris, 1966
(Melonhead whale)

MATERIAL

*JM4702, Mission Beach (17°56'S, 146°06'E), 22.x.69; *JM4730, Crystal Beach, Mt Spec (18°56'S, 146°19'E), 3.xii.75; JM5573, Eager's Creek, Moreton Is. (27°07'S, 153°27'E), QDEH, beachcast, 19.xii.86:

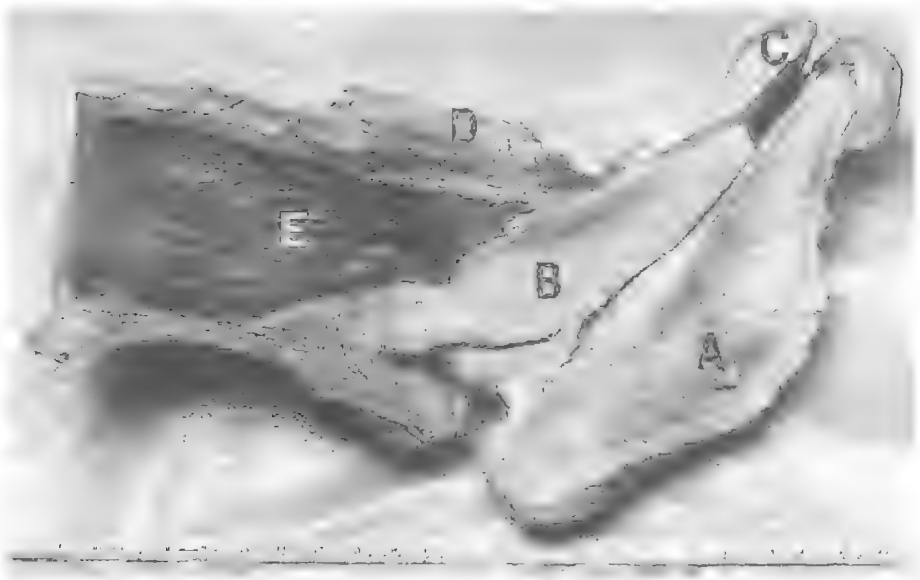

FIG. 5 *Physeter macrocephalus*, JM9920. Larynx in longitudinal section, medial aspect, with thyroid cartilage removed. A, epiglottic cartilage; B, arytenoid cartilage-corpus; C, arytenoid cartilage-rostral end; D, cricoid cartilage; E, tracheal lumen.

skull and mandible; JM6464, Moreton Is. (27°11'S, 153°24'E), QDEH, beachcast, 24.vii.77: complete skeleton; JM6577, Dunwich, North Stradbroke Is. (27°30'S, 153°24'E), Sea World staff, stranded, 6.vii.88: complete skeleton; JM10112, Rainbow Beach (25°50'S, 153°04'E), P. Stumkat, K. Williams, 1.vii.93, beachcast: complete skeleton; JM10113, Dept. of Veterinary Anatomy, University of Queensland: complete skeleton.

Family DELPHINIDAE

Grampus griseus Cuvier,1812
(Risso's dolphin)

MATERIAL
JM9452, Amity Point; North Stradbroke Is. (27°24'S, 153°26'E), SVD, J. Conrad, beachcast, 10.ii.92: complete skeleton.

Orcaella brevirostris Gray,1866
(Irrawaddy River dolphin)

MATERIAL
*JM4700, Pallarenda, Townsville (19°12'S, 146°46'E), 23.ix.69; *JM4704, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 23.iv.71; *JM4705, *JM4706, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 23.iv.70; *JM4707, Pallarenda, Townsville (19°12'S, 146°46'E), 3.x.70; *JM4708, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 13.xii.70; *JM4709, Horseshoe Bay, Magnetic Is (19°07'S, 146°51'E), 23.i.71; *JM4720, Kissing Point, Townsville (19°14'S, 146°48'E), 18.iii.72; *JM4721, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 21.iv.72; *JM4722, *JM4723, Pallarenda, Townsville (19°12'S, 146°46'E), 18.viii.74; *JM4727, The Strand, Townsville (19°16'S, 146°48'E), 28.iii.75; *JM4729, Kissing Point, Townsville (19°14'S, 146°48'E), 27.viii.75; *JM4734, Pallarenda, Townsville (19°12'S, 146°46'E), 30.vii.76; *JM4735, Rowe's Bay, Townsville (19°13'S, 146°47'E), 10.ix.76; *JM4736, Rowe's Bay, Townsville (19°13'S, 146°47'E), 4.x.76; *JM4739, Ross River mouth, Townsville (19°16'S, 146°50'E), 9.viii.84; *JM4740, Tolakea, Townsville (19°09'S, 146°35'E), 30.ix.84; *JM4741, Pallarenda, Townsville (19°12'S, 146°46'E), 10.vi.71; JM4937, Main Beach, Cape Hillsborough (20°55'S, 149°00'E), P. Thompson (QDEH), beachcast, 22.i.85: skull and mandible.

Stenella longirostris Gray,1828
(Spinner dolphin)

MATERIAL
*JM4719, Michaelmas Reef (16°35'S, 146° 02'E), 1971; JM7300, Tangalooma, Moreton Is. (27°11'S, 153°22'E), Sea World staff, stranded, 7.iv.88: complete skeleton.

Stenella attenuata Gray,1846
(Spotted dolphin)

MATERIAL
JM5356, Main Beach, Gold Coast (28°00'S, 153°26'E), Sea World staff, stranded, 1986: complete skeleton; JM6433, Eager's Creek, Moreton Is. (27°07'S, 153°27'E), RAP, SVD, beachcast, 5.xii.86: skull and mandible; JM6459 (foetus of JM6433, in spirit).

Tursiops truncatus Montagu,1821
(Bottlenose dolphin)

MATERIAL
*JM4713, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 17.viii.71; *JM4715, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 10.ix.71; *JM4724, Horseshoe Bay, Magnetic Is. (19°07'S, 146°51'E), 7.x.72; JM5241, One Mile, North Stradbroke Is. (27°30'S, 153°24'E), A. Schelechoff: skull and mandible; JM5411, Elcho Is. via Darwin (11°58'S, 135°43'E), S. Wilson: skull; JM5574, Moreton Is. (27°12'S, 153°22'E), QDEH, 19.xii.86: damaged skull; JM6428, Ocean Beach, Moreton Is. (27°11'S, 153°25'E), N. Hawkins, beachcast, 22.ii.87: skull and mandible; JM6436, JM6439, M.M. Bryden: skull and mandible; JM6568, Yellow Patch, Moreton Is. (27°02'S, 153°26'E), T. Ward, J. Kahabka (QDEH), beachcast, 8.v.88: skull and mandible; JM7308, Noosa (26°35'S, 153°08'E), R. Parker, G. McDermott, drowned in shark net, 1.vii.86: head (in spirit); JM8831, Amity Point, North Stradbroke Is. (27°24'S, 153°26'E), E. Durbidge, beachcast, 16.i.92: calf (in spirit); JM8859, Maroochydore (26°40'S, 153°06'E), R. Parker, drowned in shark net, 5.vi.86: skull and mandible; JM10043, Chiggl Chiggl, North Stradbroke Is. (27°25'S, 153°26'E), SVD, 10.ii.92: damaged skull and mandible; JM10114, Point Lookout, North Stradbroke Is. (27°26'S, 153°33'E), RAP, beachcast, 14.viii.93: skull and mandible.

ACKNOWLEDGEMENTS

Stephen Van Dyck helped collect many specimens. Bruce and Carolyn Cowell photographed and prepared many specimens. Sally Elmer illustrated the minke whale larynx. Stephen Marmo, X-ray Department, Royal Brisbane Hospital took the radiographs. I am most appreciative of their assistance. Officers of the QDEH notified a number of strandings and assisted with retrieval of specimens as did officers of the QBFP.

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UNUSUAL HUMPBACK WHALE SIGHTINGS AT CAPE MORETON. *Memoirs of the Queensland Museum 35(1): 224. 1994*:- The waters adjacent to Cape Moreton (27°02'S, 153°28'E) in southern Queensland are in the migration route of Area V (130°E–170°W) humpback whales (Paterson,1991). The sightings reported here occurred during the 1993 northern migration.

On 4 July 1993 during the night of full moon RAP saw migrating humpback whales having been alerted by presumed 'social' sound.

A camp had been established on the SE aspect of Cape Moreton 65m above sea level, 100m back from the shore. A 15m walk was required to view the sea. At 1935h when atmospheric and sea conditions were perfect a 'subdued foghorn' sound was heard. The sea was scanned within a few seconds. No ships were present but blows typical of a humpback whale pair were seen close inshore approximately 150m ENE, north of the moonlit area of sea. The whales blew twice again before passing out of sight in a northerly direction. Within minutes another pair of blows was seen approximately 800m ESE. The whales were south of the moonlit area, did not surface as they traversed it, but were seen north of it 5 minutes later. In each case the transit time was consistent with that of similarly positioned humpback whales seen there during daylight.

Humpback whale population estimates in east Australia in the post-whaling period have been based on observations from elevated shore positions (Bryden et al., 1990; Paterson & Paterson, 1989) and those authors assumed that migration rates are similar during day and night. This fortuitous sighting, although of limited duration, supports that assumption.

It is likely that the alerting sound was produced by one of the inshore pair. Humpback whales produce complex underwater sounds or songs (Payne & McVay, 1971). The sound reported above is not included in those underwater sounds described by Cato (1991) for the east Australian stock but may have been a 'social' sound (D.H. Cato, pers. comm.). On 4 September 1992 numerous 'social' sounds were heard by RAP when watching four humpback whales <400m from the headland at Point Lookout (27°26'S, 153°33'E) between 0715 and 0730h. The group was southbound and moving slowly while remaining at the surface. Atmospheric and sea state conditions were favourable and the sounds were similar to those made by lowing cattle. On 12 October 1980 one of a group of three southbound humpback whales <100m from the same headland raised its head from the sea on a number of occasions and made a barking noise. Cato (1991) refers to that sound as a 'yap' and notes that it occurs when singing whales surface to breathe.

On 27 July 1993 MRK witnessed probable humpback whale parturition during a whale watch cruise.

The captain of the 'Tangalooma Flyer' had been informed by the lighthouse keeper at Cape Moreton at 1145h that a solitary humpback whale was stationary at the surface 2km WSW of the Cape. Viewing conditions were perfect and the whale was readily located 15 minutes later. It remained stationary for a further 30 minutes before rising horizontally as if being inflated. Approximately 1/3 of its body was above the water and its head and flukes were visible. It then 'subsided' and soon after a small grey coloured calf approximately 3–4m long appeared at its side close to the pectoral region. The pair then slowly moved away and were not followed.

Paterson & Paterson (1989) reported three accounts of probable humpback whale parturition witnessed by others in Great Barrier Reef waters between lat. 18–20°S in the months of August and September. Simmons & Marsh (1986) consider that the central section of the Great Barrier Reef is an important breeding ground for the east Australian stock. However, occasional parturition occurs at latitudes higher than Cape Moreton as northbound mothers and calves have been seen in that region (Paterson & Paterson, 1989) and Paterson et al. (1993) reported the stranding of a recently born calf on Moreton Island on 19 July 1991. The events described above are not conclusive proof of parturition and absolute proof is usually lacking in such reports of free-ranging cetaceans. However, the observation of a solitary animal, stationary for a considerable period, with the subsequent sudden appearance of a small lightly pigmented calf supports the possibility of parturition.

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NEW QUEENSLAND COCKROACHES OF *MACROCERCA* HANITSCH AND *PERIPLANETA* BURMEISTER (BLATTIDAE)

LOUIS M. ROTH

Roth, L.M. 1994 06 01: New Queensland cockroaches of *Macrocerca* Hanitsch and *Periplaneta* Burmeister (Blattidae). *Memoirs of the Queensland Museum* 35(1): 225-233. Brisbane. ISSN 0079-8835.

The New Guinean cockroach genus *Macrocerca* Hanitsch is reported from Australia for the first time. *M. hopensis* sp.nov., *M. shiptona* sp.nov., and *M. shelfordi* Princis occur in northern Queensland. *Periplaneta aboriginea* sp.nov. is described from Cape York Peninsula. □
Blattidae, Macrocerca, Periplaneta, new species, taxonomy, north Queensland.

Louis M. Roth, Museum of Comparative Zoology, Harvard University, Cambridge, MA, 02138, USA; correspondence: P.O. Box 540, Sherborn, MA, 01770, USA; 15 November 1993.

I recently redescribed the 2 known species of *Macrocerca* Hanitsch, described 7 new taxa, and placed the genus in the Blattidae, and new subfamily Macrocercinae. All of the species are found in New Guinea and one also occurs on Key Island. While my revision of the genus (Roth, 1993) was in press, I received a number of specimens of *Macrocerca* from the Australian National Insect Collection (ANIC), Canberra, ACT, and the Queensland Museum (QMBA), Brisbane, Queensland. The material contained 3 species of which one was *M. shelfordi* Princis whose previously unknown female is described below.

The other 2 species are new and are here described.

SYSTEMATICS

KEY TO MALES OF AUSTRALIAN *MACROCERCA*

(A key to New Guinea species is given in Roth, 1993)

1. Head whitish with a medial, reddish brown longitudinal stripe surrounded by small dots on the face (Fig. 2A) ..... *shiptona*

   Head not as above 2

2. Head black or black with a reddish tinge from the occiput to the clypeus with a large white macula on the upper half of the face between the eyes and antennal sockets (Fig. 3A) ..... *hopensis*

   Head with occiput light brown becoming darker on vertex and continuing as a longitudinal dark brown stripe to the clypeus (dark specimens, as in ♀, Fig. 1A); in light specimens the stripe is variably reduced and may be absent (as in ♀, Fig. 1B, C) . *shelfordi*

Macrocerca shelfordi Princis
(Fig. 1)

Macrocerca shelfordi Princis, 1965: 143, fig.6 (♂); Roth, 1993: 350, fig. 4A-D (♂).

MATERIAL EXAMINED

Queensland, ANIC: Coll. D.C.F. Rentz: 3km ENE of Mt Tozer, nr Iron Range Nat. Park, 12°44'S 143°14E, 2 ♂♂, 28.vi.-4.vii.1986 (1 collected as nymph, matured 23.xii.1987), 2 ♀♀, Stop I-3; 9km ENE of Mt Tozer, Iron Range Nat. Park, 12°43'S 143°17'E, rainforest margin, 3 ♀♀, 10.vii.1986, Stop I-12; 11km ENE of Mt Tozer, nr Iron Range Nat. Park, rainforest margin, 12°44'S 143°18'E, rainforest margin, 1 ♂, 11.vii.1986, Stop I-20; 13km ENE of Mt Tozer nr Iron Range Nat. Park, low open forest, 12°42'S 143°20'E, 4 ♀ ♀ (1 carrying an ootheca in the vertical position), 13.vii. 1986, Stop I-21. Three specimens retained in the MCZ. QMBA: Coll. G.B. Monteith: 3km E of Lockerbie, Cape York, NQ, 1 ♀, 30.i-4.ii.1975; Gordon's mine area, Iron Range, NQ, rainforest, 1 ♂, 12-19.ii.1976; 1 ♀, 12-18.ii.1976; Iron Range, Cape York Pen., NQ, 1 ♀ (carrying partially complete ootheca), 27-30.iv.1973. The following were collected by G.B. Monteith & D. Cook: Eet Hill Vicinity, Moa (Banks) Is., Torres Strait, NQ, 1 ♀, 9-13.vii.1977; St. Pauls, Moa (Banks) Is., Torres Strait, NQ, 1♀, 14-17.vii.1977; 5km WSW of St. Paul's, Moa (Banks) Is., Torres Strait, NQ, 1 ♂, 16.vii.1977; West Claudie R., Iron Range, NQ, rainforest, 50m, 1 ♀, 3-10.xii.1985.

DESCRIPTION

Female (previously unknown). Head with interocular space less than distance between anten-

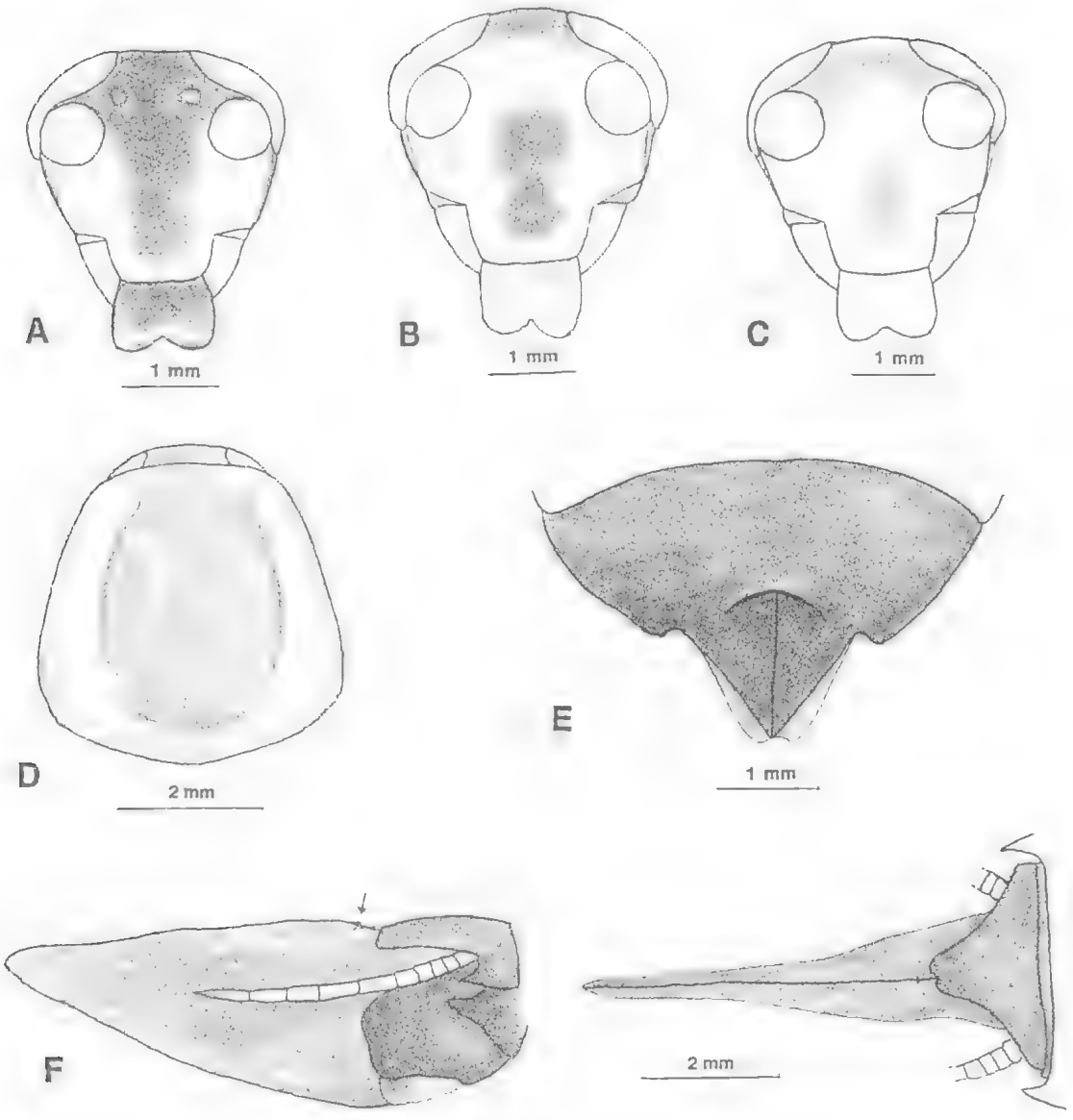

FIG. 1. *Macrocerca shelfordi* Princis, ♀♀ from Queensland. A-C, heads; D, pronotum; E, subgenital plate (ventral; lateral margins of the supraanal plate are visible); F, lateral (left) and dorsal (right) views of an ootheca protruding from the female's vestibulum [arrow indicates a minute serration or tooth (respiratory opening for an egg) in the keel]. Localities: All specimens were collected various distances ENE of Mt Tozer, as follows: A, B,9 km; C, 3km; D-F, 13km.

nal sockets (Fig. 1A-C). Tegmina and wings fully developed extending beyond end of abdomen, the former with longitudinal and oblique discoidal sectors. Hind wing with simple or branched media vein, cubitus with 3 or 4 complete (some with 1 or more branches) and 2 incomplete rami. Anteroventral margin of front femur without piliform spinules although there may be a few minute, stout, widely spaced spines, with 2 large terminal spines; large pulvilli on 4 proximal tarsomeres, tarsal claws strongly asymmetrical, simple, arolia well developed, as large as the

smallest claw. Abdominal terga unspecialized, supraanal plate subtrigonal, apex shallowly indented (Fig. 1F, right). Subgenital plate with a strongly curved distal division well separated from the lateral margin, forming a pair of contiguous valvular lobes (Fig. 1E).

Colour. Variable. Dark specimens: Occiput light brown becoming darker on the vertex and continuing as a broad longitudinal dark brown band to the clypeus, background color whitish, labrum brown, its distal region whitish (Fig. 1A). Pronotal disk reddish brown without markings, lateral areas hyaline, lateral margins narrowly yellowish (Fig. 1D). Tegmina yellowish brown, hyaline, with the subcostal region and the area of simple costal veins white, radial vein dark brown for a little more than half its length. Hind wing with subcostal and large part of the costal vein region white, distal part of the anterior field yellowish, posterior field practically colourless.

Abdominal terga blackish with a narrow brown stripe mesad on the proximal segments, supraanal plate mostly brown. Abdominal sterna black, or some with irregular lateral maculae laterally and with the subgenital plate or subgenital plate and preceding segment reddish brown. Cerci reddish brown dorsad, darker brown ventrally. Coxae black, femora dark brown, tibiae light brown their outer margins dark brown, tarsomeres light brown with dark ventral margins.

The amount of black is often variably reduced and most specimens are lighter than the above. Dark areas on the head are variably reduced (Fig. 1B,C) and may be absent completely. The lateral borders of the pronotum may be partly or completely white or whitish. The abdomen may have some reddish brown or brown, with some yellowish areas. Cerci and legs may be light brown.

Measurements (♂ measurements include those from Roth,1993; ♀ in parentheses). Length, 16.5-19.5 (16.5-21.0); pronotum length x width, 4.2-4.7 x 4.4-5.0 (4.3-5.4 x 4.2-5.6); tegmen length, 16.7-18.9 (14.7-19.2); interocular width, 0.6-0.8 (0.8-0.9).

Ootheca. The oothecae of the Blattidae (Blattinae and Polyzosteriinae) are remarkably uniform. The eggs are arranged vertically two by two and covered by a thick darkly sclerotized wall with a characteristic serrated keel, each tooth representing the position of a respiratory tubule connecting an egg chamber with the atmosphere (Roth,1968: figs 5-36). Only one partly formed ootheca, that of *Macrocerca strazanaci* Roth, was previously known (Roth,1993: fig.5G). It differs strongly from the oothecae of other blattids. Unfortunately the present 2 oothecae of *Macrocerca shelfordi* also are incompletely formed even though the amount protruding from the abdomen measures 5 mm in the largest specimen. Like that of *strazanaci*, the keel region lacks serrations except for one minute tooth near the apex of the subgenital plate (Fig.1F, left, arrow). Whether or not the exposed part of the ootheca contains eggs was not determined. It is possible that this exposed region does not contain eggs and that the small tooth may be the region where the first egg is deposited, and the rest of the eggs are deposited (with minute serrations indicating their positions) in that part of the egg case hidden in the female's vestibulum.

REMARKS

This species was previously known only from Key Island

Macrocerca shiptona sp.nov.
(Fig. 2)

MATERIAL EXAMINED

HOLOTYPE: ♂, Shiptons Flat, nr Cooktown, Queensland, 15°47'S 145°14'E, 19.x.1980, T.A. Weir & R.A. Barrett, ANIC.

ETYMOLOGY

From Shiptons Flat, the type locality.

DESCRIPTION

Male. Head with interocular space less than distance between antennal sockets (Fig. 2A); antennae filamentous, about twice as long as the body. Pronotum suboval, slightly wider than long (Fig. 2B). Tegmina and wings fully developed extending beyond end of abdomen, the former with longitudinal and oblique discoidal sectors. Hind wing with branched media vein, cubitus vein with 6-8 complete (some of them with 1 or more branches) and 1-3 incomplete rami, apical triangle subobsolete. Anteroventral margin of front femur with very fine setae (but not spinules), terminating in 2 large spines, ventral margins of mid and hind femora with few small, stout, widely spaced spines; 4 proximal tarsomeres with large pulvilli, tarsal claws simple, strongly asymmetrical, arolia well developed, as large as the smallest claw. First abdominal tergum with a dense, longitudinal group of setae, and a pair of large groups on either side of it (Fig. 2D). Lateral corners of abdominal segment 7 acutely produced, the corners of the sixth tergum much less produced (Fig. 2C); supraanal plate

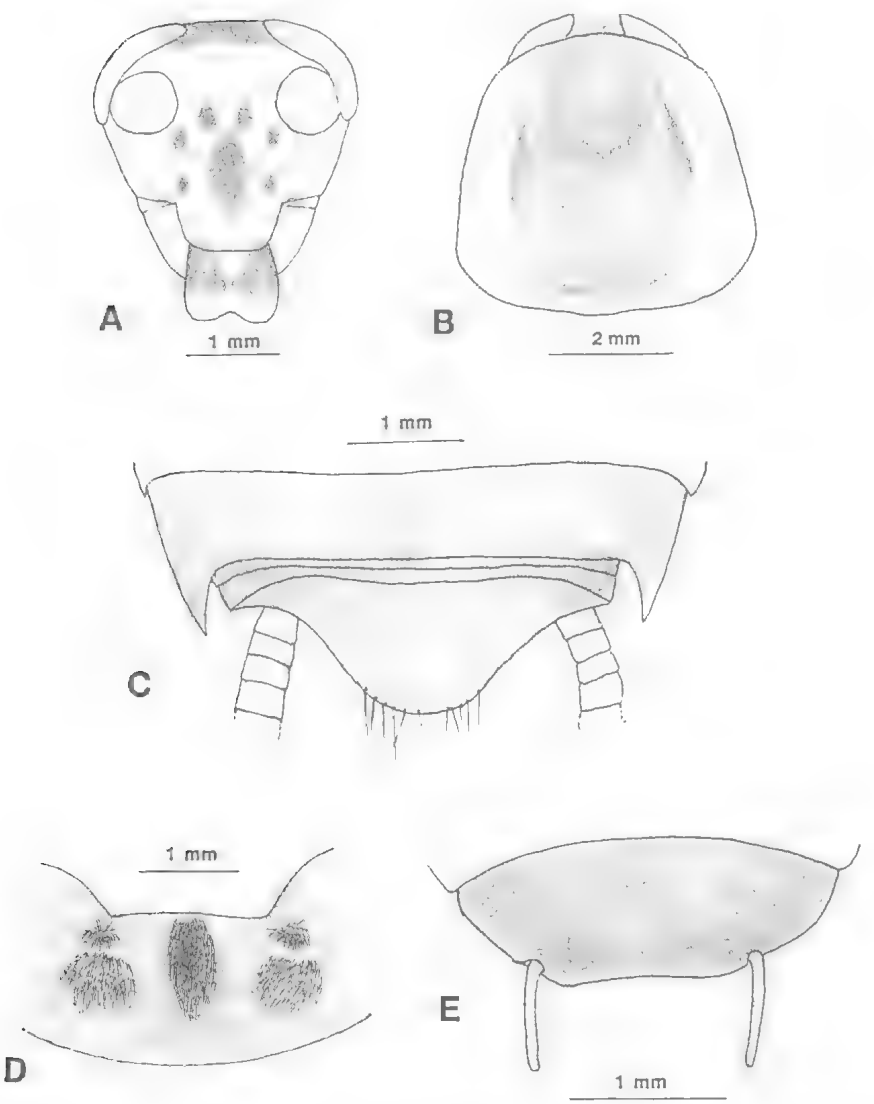

FIG. 2. *Macrocerca shiptona* sp.nov., ♂ holotype. A, head; B, pronotum; C, abdominal terga 7 to 10 (supraanal plate); D, setal modification on first abdominal tergum; E, subgenital plate (ventral).

convexly rounded (Fig. 2C). Subgenital plate weakly asymmetrical, the left lateral margin more convex, styles similar, slender, sclerotized, interstylar margin almost straight (Fig. 2E), reaching apex of the supraanal plate. Genitalia completely hidden. Cerci about 4 times longer than the supraanal plate.

Female. Unknown.

Colour. Head with occiput pale yellowish, vertex with a dark brown transverse band, rest of face whitish (particularly between the eyes) with a mediolongitudinal reddish brown stripe and 6 small, distinct dots of the same colour, labrum reddish brown and whitish (Fig. 2A); maxillary palpomeres pale; antennae brown. Pronotal disk reddish brown, lateral border regions subhyaline with some opaque white areas (Fig. 2B). Tegmina with subcostal and most of the costal vein zones white, remainder uniformly brownish yellow, hyaline. Hind wing with the subcostal area and a

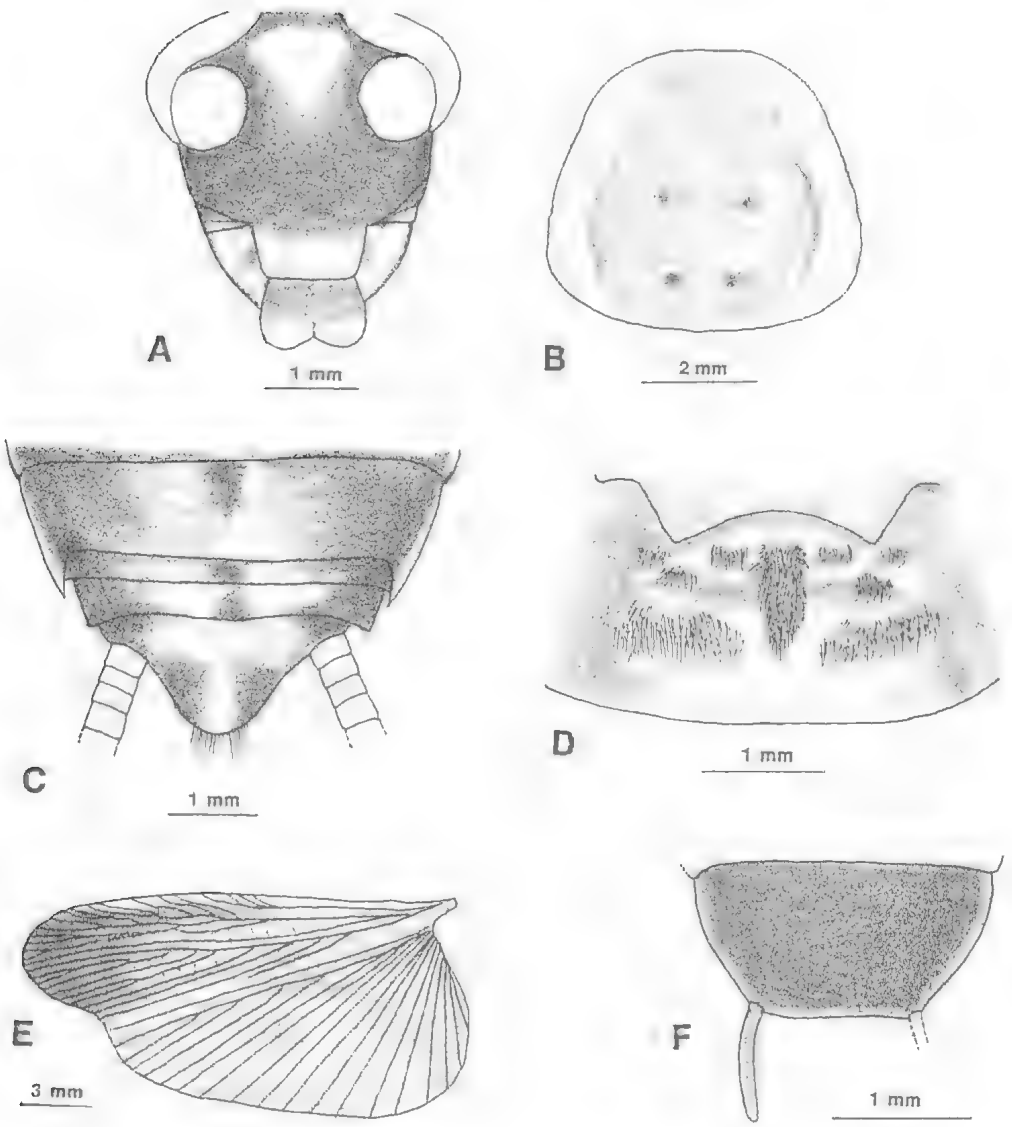

FIG. 3. *Macrocerca hopensis* sp.nov., ♂ holotype. A, head; B, pronotum; C, abdominal terga 7-10 (supraanal plate); D, setal gland on first abdominal tergum; E, hind wing; F, subgenital plate (ventral; left style broken).

small distal region of the proximal costal veins white,, distal part of the anterior field brownish yellow, posterior field colourless. Abdominal terga brown with wide lateral regions slightly darker. Abdominal sterna with the last three segments brown, the more anterior segments mostly black with some small lighter brown lateral spots. Cerci brown, dorsal surface somewhat lighter. Legs brown.

Measurements. Length, 18.2; pronotum length x width, 4.7 x 5.0; tegmen length, 19.0; interocular width, 0.8.

Macrocerca hopensis sp.nov.
(Fig. 3)

MATERIAL EXAMINED
HOLOTYPE: ♂, 14km W by N of Hope Vale mission,

nr Cooktown, Queensland, 15°16'S 144° 59'E, 7-10.v.1981, D.C.F. Rentz, Stop 34, ANIC.

ETYMOLOGY

For the Hope Vale mission.

DESCRIPTION

Male.Interocular space less than the distance between antennal sockets (Fig. 3A). Pronotum suboval slightly wider than long (Fig. 3B). Tegmina and wings fully developed extending beyond the abdomen, the former with longitudinal and oblique discoidal sectors. Hind wing with branched media vein, cubitus vein with 6 or 7 complete (some of them forked 1 or more times), and 1 incomplete branches, apical triangle absent (Fig. 3E). Front femur with a row of minute setae, some of them of the same length but shorter and finer than spinules, with 2 large terminal spines; very few or no large spines on the ventral surfaces of the mid and hind femora; large pulvilli on 4 proximal tarsomeres, tarsal claws simple, strongly asymmetrical, arolia well developed, as large as the smaller claw. First abdominal tergum specialized with a dense longitudinal group of setae medially and 4 setal groups of various sizes on either side of the middle one (Fig. 3D). Posterolateral corner of the seventh abdominal tergum acutely produced, supraanal plate trigonal, apex rounded (Fig. 3C). Cerci about 4 times longer the the supraanal plate. Subgenital plate almost symmetrical, styles elongated, slender, sclerotized (the left one is missing but probably is similar to the intact one), interstylar margin straight (Fig. 3F). Genital phallomeres protrude from under the supraanal plate and the hook curves from the left side with its blunt apex reaching the right phallomere.

Female. Unknown.

Colour. Occiput and vertex of head black, with a white inverted trigonal macula between the eyes and upper half of the antennal sockets, the face down to the clypeus and mandibles blackish with some reddish tint, mandibles mostly pale yellowish, clypeus light reddish, labrum reddish brown, the distal region yellowish (Fig. 3A). Pronotal disk reddish brown with 4 small, weak dots on the distal half, lateral border regions subhyaline, the margin area white (Fig. 3B). Tegmina reddish brown, the subcostal and most of the costal vein regions white, radial vein dark. Hind wing with subcostal region and distal parts of some of the proximal costal veins white, the distal region of the anterior field dark brown, the remainder with a yellowish tinge, posterior field pale (Fig. 3E). Abdominal terga with a brown medial longitudinal stripe, lighter brown on either side of it and with broader dark brown in the lateral zones (Fig. 3C). Abdominal sterna completely black. Cerci reddish dorsally, dark brown ventrally. Legs with coxae and tibiae dark brown, femora blackish brown, tarsi lighter brown.

Measurements. Length, 21.0; pronotum length x width, 4.8 x 5.0; tegmen length, 20.5; interocular width, 0.6.

Periplaneta Burmeister

Princis (1966: 405; 1971: 1145) catalogued 47 species of *Periplaneta* world wide and Asahina (1980: 103) added 2 new species and 3 new combinations. Princis (1966: 446) included *Periplaneta basedowi* Tepper from South Australia but that species belongs in *Ataxigamia* (Rentz & Cameron,1983:7). Mackerras (1968: 560) listed the following 5 species of Blattinae, all introduced into Australia and circumtropical domiciliary pests, although some may be found outdoors: *P. americana* (Linnaeus), *P. australasiae* (Fabricius) (both widespread in towns in tropical and subtropical parts of Queensland), *P. brunnea* (Burmeister) (= *P. ignota* Shaw) (Queensland), *Blatta orientalis* Linnaeus (South Australia), *Neostylopyga rhombifolia* (Stoll) (Northern Territory). Mackerras (1968: 560) provided a key to distinguish these species, and Peck & Roth (1992: 2204, fig. 2A-L) did the same for 3 species of *Periplaneta*. I have also examined a specimen of another circumtropical domiciliary pest, *Periplaneta fuliginosa* (Serville) from Iron Range.

Dr G. B. Monteith sent me 5 specimens of a *Periplaneta* that occurs in a natural rainforest at Iron Range in northern Queensland, and which I describe below as new. I am also including some Australian records of 4 other domiciliary species of *Periplaneta*.

Periplaneta americana (Linnaeus)

MATERIAL EXAMINED

Queensland. ANIC: Green Is., 28kms NE of Cairns, Qld, 1♂, 1♀, 1.iv.1988, D.C.F. Rentz, Stop A-38.

Periplaneta brunnea (Burmeister)

MATERIAL EXAMINED

Northern Territory, ANIC: Flying Boat Base, Groote Eylandt, 1♀, ix.1940. Queensland. ANIC: Roma District, 1♀.

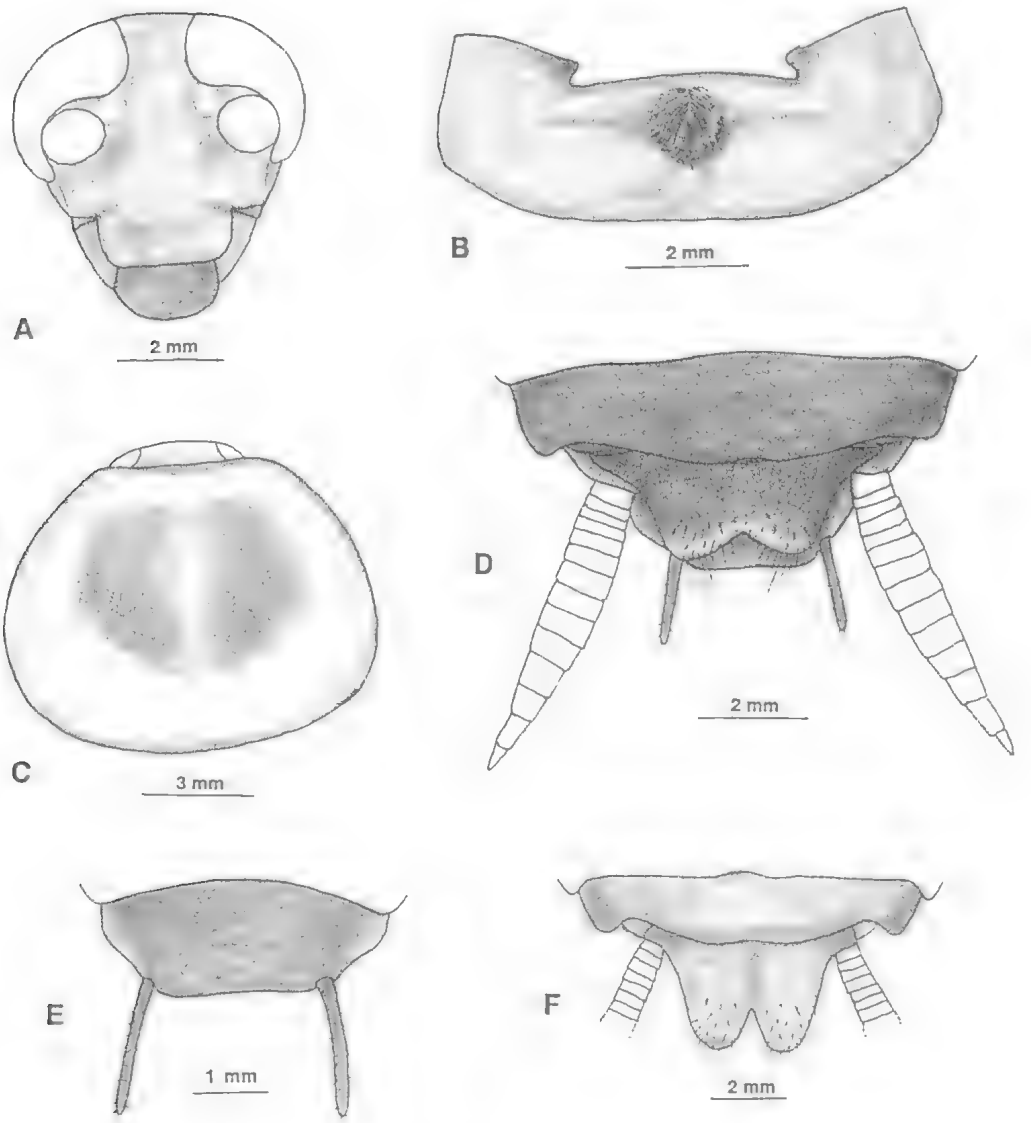

FIG. 4. *Periplaneta aboriginea* sp.nov. A-E, ♂ holotype; F, ♀ paratype from Gordon's Mine Area. A, head; B, setal gland on first abdominal tergum; C, pronotum; D, terminal abdominal segments (dorsal); E, subgenital plate (ventral); F, terminal abdominal terga.

REMARKS

Both females have slightly reduced tegmina and wings that only reach to the end of the abdomen.

Periplaneta fuliginosa (Serville)

MATERIAL EXAMINED

New South Wales, ANIC: Sydney (Greenacre), 1 ♂, H.M. Cameron, (Revesby), 1 ♀, x.1984-i.1985, L.V. Barnet.

Periplaneta australasiae (Fabricius)

MATERIAL EXAMINED

Queensland, ANIC: Mt Carbine, 2♂♂, 1♀, 5.v.1945, T.W. Gamble; Foleyvale, Aboriginal Res., 4♂♂, 10-25.i.1988, 2♂♂, 20-25.i.1968, G. Hangay; Atherton (CSIRO Labs), 17°17'S 145°29'E, 1♂, 3.iii.1988, 1♀, 20.iii.1988, 1♀, 22.iii.1988, D.C.F. Rentz, Stop A-1; Green Island, 28km NE of Cairns, Qd, 16°46'S 145°59'E, 1♂, 1.iv.1988, D.C.F. Rentz, Stop A-38; Heron I., 84km SW by W of Gladstone, 23°26'S 151°55'E, 1♂, 1♀, 15-19.vii.1983, D.C.F. & B.G.F. Rentz, Stop 32. New South Wales. ANIC: Durras North, nr Batemans Bay, 1♀, iv.1981, H.M. Cameron.

Periplaneta aboriginea sp.nov.
(Fig. 4)

MATERIAL EXAMINED

HOLOTYPE: ♂, ABRS area 2, 142°45'E 11°40'S, Dividing Range, Cape York Pen., NQ [Queensland], 5-12.ii.1976, G.B. Monteith, QMBA.

PARATYPES: Queensland. QMBA: Coll. G.B. Monteith: Gordon's Mine Area, Iron Range, NQ, rainforest, 1♀, 12-18.ii.1976; Dividing Range. 15km W of Captain Billy Creek, Cape York Pen., NQ, 142°45'E. 18°40'S, 1♀ (in very poor condition), 4-9.vii.1975; Mt Tozer, Iron Range, NQ, 1-1500', 1♀, 30.iv.1973; Iron Range, Cape York, Pen., NQ, 1♂, 30.vi.-4.vii.1977 (retained in MCZ).

DESCRIPTION

Male. Head with interocular space less than the distance between antennal sockets (Fig. 4A). Pronotum suboval, widest near the middle (Fig. 4C). Tegmina and wings fully developed extending beyond end of abdomen. Anteroventral margin of front femur with 15-18 stout spines that decrease slightly in length distad, the 2 or 3 terminal spines longer; posteroventral margin with 4 spines; ventral margins of mid and hind legs with 6-8 large spines; small apical pulvilli on 4 proximal tarsomeres, tarsal claws simple, symmetrical, arolia small. First abdominal tergum with a large, dense group of setae anteromedially (Fig. 4B). Supraanal plate not membranous, hind margin with a broad, shallow, V-shaped excavation forming a pair of apically rounded lobes that reach the hind margin of the supraanal plate, their distal halves with long slender setae (Fig. 4D); subgenital plate transverse, styles slender, similar, almost equal to the length of the plate, interstylar margin truncate (Fig. 4E). Cerci slender, dorsally flattened, almost 3 times the length of the supraanal plate (Fig. 4D).

Colour. Head yellowish brown, labrum, maxillary and labial palpi reddish brown; antennae brown. Pronotum with a reddish brown blotch, lighter mediolongitudinally, and surrounded by yellowish (Fig. 4C). Tegmina dark reddish brown. Hind wing with anterior field yellowish brown, darker along the costal vein area. Proximal 4 abdominal terga yellowish brown, the remaining segments dark brown, with the distal region of the supraanal plate lighter brown (Fig. 4D). Abdominal sterna uniformly reddish brown, or with some segments darker on their distal halves. Cerci and legs reddish brown.

Female. Supraanal plate not membranous, hind margin with a narrow V-shaped excision (Fig. 4F), the rounded apexes of the lobes reach the tips of the subgenital plate valves which can be seen in dorsal view between the excision. Colour essentially similar to that of the male.

Measurements (♀ in parentheses). Length, 31.5-35.2 (34.0-40.0); pronotum length x width, 8.1-9.0 x 10.4-11.6 (9.0-9.5 x 12.2-12.6); tegmen length, 33.1-36.4 (34.5-?); interocular width, 1.1-1.3 (1.5-1.6).

REMARKS

The habitus of this species resembles that of *P. americana* but the male has a large tergal gland on the first abdominal segment and its supraanal plate differs; the male American cockroach lacks a tergal gland, its supraanal plate is membranous and differently shaped (cf. Fig. 4D with fig. 2E *in* Peck & Roth, 1992).

Incertae sedis
?Periplaneta australis (MacLeay, 1827)

Blatta australis MacLeay, 1827: 454 (male).
?Periplaneta australis (MacLeay): Kirby, 1904: 142; Shelford, 1910: 19; Princis, 1966: 456.

HOLOTYPE

♂, N. Australia (not examined).

REMARKS

According to the Curator of the MacLeay Museum, the type of *Blatta australis* is not in that museum (G. B. Monteith, pers.comm.).

As earlier workers have indicated, it is impossible to place this species based on the description given by Macleay (1827) which did not even suggest its size.

ACKNOWLEDGEMENTS

I thank Dr D.C.F. Rentz of CSIRO and Dr G.B. Monteith of the Queensland Museum for sending me specimens. I am grateful to the Australian Biological Resources Study (ABRS) for partial support.

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NEW DATA ON *CRYPTOBLEPHARUS FUHNI*, A POORLY KNOWN SKINK FROM QUEENSLAND. *Memoirs of the Queensland Museum 35(1) 234.1994:-* *Cryptoblepharus fuhni* Covacevich & Ingram, 1978 is known only from its type locality, the Melville Range (14°16'S, 144°30'E) on Cape York Peninsula. This range is composed entirely of granite boulders. *C. fuhni* is recognised as warranting special status in management plans by McDonald et al. (1991), as '2RC' i.e.' ...with a very restricted distribution ... with a maximum geographic distribution of less than 100km ... rare ... but not currently considered endangered or vulnerable ... within a national park...'.

Description of *C. fuhni* was based solely on museum specimens (8), all of which had been damaged by dust shot. A photograph of living *C. fuhni* was not available for the description, and none has been published in any of the major identification guides to Australia reptiles. (e.g. Wilson & Knowles, 1988; Ehmann, 1992; Cogger, 1992). No additional specimens of *C. fuhni* have been collected, and it remains poorly known, presumably because of the remoteness of the Melville Range.

In September, 1992, I visited the type locality of *C. fuhni* from Bathurst Bay (14°13'S, 144°22'E) to Cape Melville (14°10'S, 144°30'E) and was able to photograph (Figs 1-3), and examine closely specimens of *C. fuhni* from different parts of the range.

The colour and pattern description of *C. fuhni* of Covacevich & Ingram (1978) is accurate. The type specimens are young adults. All were collected on black boulders remote from the sea, near Bathurst Bay (J. Covacevich, pers. comm.). Juveniles from this area are similar, but more distinctly patterned. Large, apparently old adult specimens have the same pattern as juveniles and young adults, but it is poorly defined and on a dull brown-black background (vs black). At Cape Melville the boulders of the range enter the sea, and are wave-washed to a pale grey. Here the skinks retain the distinct pattern, but have a pale greyish background colour.

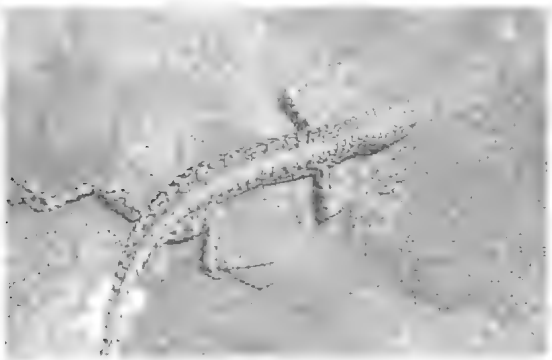

FIG.1. *C. fuhni* juvenile, from black boulders near Bathurst Bay.

FIG. 2. *C. fuhni* old adult, from black boulders near Bathurst Bay.

FIG. 3. *C. fuhni* typical pale-coloured specimen, from pale sea-washed boulders, Cape Melville.

Individuals of *C. fuhni* are very common on the Melville Range. They are extremely agile, fast-moving skinks which spend the day foraging on the boulder faces. During the hottest part of the day, they retreat to crevices and cracks in the boulders or into the deep shade between them.

Acknowledgements

Jeanette Covacevich alerted me to the value of these photographs and assisted me to present this note.

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Lewis Roberts, Shipton's Flat, via Cooktown, Queensland 4072, Australia; 26 February 1994.

A NEW SPECIES OF FRESHWATER CRAB (SUNDATHELPHUSIDAE) FROM CAPE YORK PENINSULA

JOHN W. SHORT

SHORT, J.W. 1994 06 01: A new species of freshwater crab (Sundathelphusidae) from Cape York Peninsula. *Memoirs of the Queensland Museum* **35** (1): 235-240. Brisbane. ISSN 0079-8835.

A new species of freshwater sundathelphusid crab, *Holthuisana (Austrothelphusa) tigrina*, from a single locality on Cape York Peninsula, northern Queensland is described. It resembles *H. (A.) transversa* (Martens,1869) from which it is distinguished by its distinctive striped colour, carapace proportions, relatively large eyes, and features on the telson, third maxilliped and inferior orbital margin. □ *Crustacea, Sundathelphusidae, Holthuisana, new species, Queensland, freshwater, taxonomy, biology.*

John W. Short, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; *27 November 1993.*

Australian sundathelphusid crabs have been revised by Riek (1951), Bishop (1963) and briefly reviewed by Bott (1970). Bishop (1963) recognised *H. (A.) agassizi* (Rathbun,1905), *H. (A.) angustifrons* (A. Milne Edwards,1869), *H. (A.) raceki* (Bishop,1963), *H. (A.) transversa* (Martens,1869), *H. (A.) valentula* (Riek,1951), and *H. (A.) wasselli* (Bishop,1963). Bott (1970) considered only two of these valid, *H. (A.) angustifrons* and *H. (A.) transversa*. He suggested that the other four fall within the range of variation of *H. (A.) angustifrons* but formally synonymised only *H. (A.) agassizi*. Furthermore his findings were based on only 25 specimens from a very restricted range of localities. Presumably on the basis of Bott's work, Williams (1980) and Horwitz (1990) listed only two Australian species. I have examined the Queensland Museum's extensive collection of ssundathelphusids and support Bishop (1963) in recognising six species.

Holthuisana (A.) tigrina sp.nov. was first brought to my attention by Mr Leigh Bulley in 1991. Two live specimens were sent to the Queensland Museum for identification and were immediately recognisable as new to science on the basis of their distinctive striped colouration and external morphology. Mr Gordon Staples provided further specimens, including females and small males, from the type locality.

MATERIAL AND METHODS

All material examined is housed in the Queensland Museum. The description is based primarily on the male holotype with paratypic variation included as comments within parentheses. Measurements were made using vernier calipers and line drawings with the aid of a camera lucida. The first pereiopods are referred to as chelipeds. Abbreviations used in text: CB, carapace breadth; QM, Queensland Museum; SWQ, southwest Queensland.

SYSTEMATICS

Holthuisana (Austrothelphusa) tigrina sp.nov.
(Figs 1-6)

MATERIAL EXAMINED

HOLOTYPE: QMW18822, ♂ (35.4mm CB), headwaters of One Mile Ck, a tributary of the Alice River, 15°27'S, 143°16'E, Apr 1991, L. Bulley.

PARATYPES: QMW17162, ♂ (36.0mm CB), same collection data as holotype; QMW19027, 7♂♂ (21.5 - 29.7mm CB), 5♀♀ (21.8 - 25.1mm CB), same locality data as holotype, Apr 1990, G. Staples.

DESCRIPTION

Cephalothorax. Dorsal carapace strongly convex longitudinally, moderately convex transversely; breadth c.1.25 x length, c.2.1 x depth; dorsum punctate, glabrous; front slightly concave; anterolateral regions lacking striae, margins feebly carinate, with V-shaped notch between exorbital angle and epibranchial margin; supraorbital and exorbital angles entire, inferior orbital angle distinctly crenulate; posterolateral regions converging, straight, with distinct oblique striae; posterior margin more or less straight; epigastric regions poorly defined; cervical grooves poorly defined; gastric groove distinct, H-shaped; posterior metagastric region rugose; urogastric region well defined; cardiac and intes-

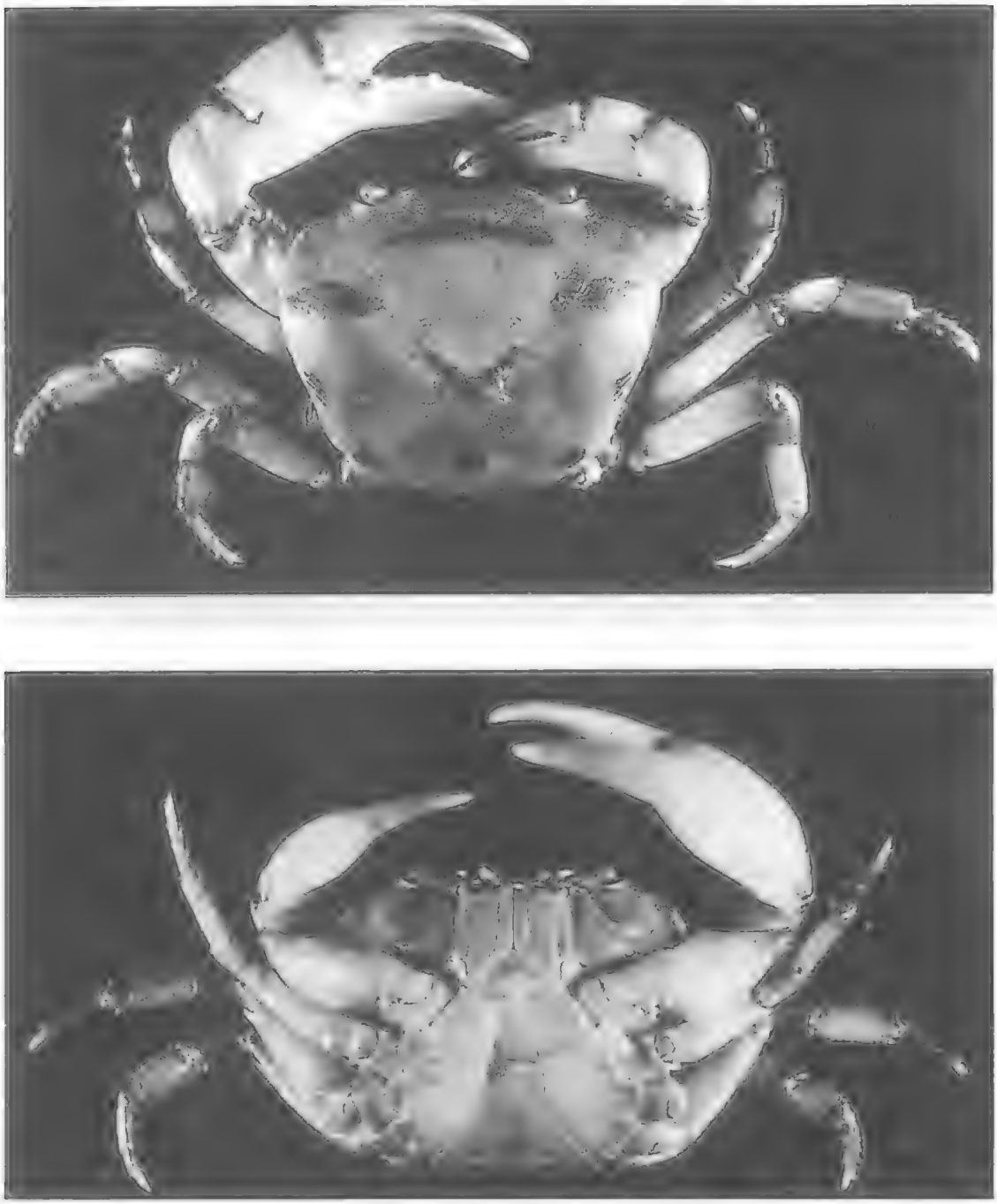

FIG.1. *Holthuisana (Austrothelphusa) tigrina* sp.nov., holotype ♂, QMW18822. Dorsal and ventral views. Scale divisions in mm.

tinal regions poorly defined; branchial regions uninflated; subhepatic regions smooth; suborbital regions slightly rugose; pterygostomial regions rugose anteriorly with anterior mesial margin crenulate; posterior margin of epistome smooth, median triangle distinct, tuberculate. Eyes large, eyestalks distally expanded to accommodate large cornea. Third maxillipeds of typical shape

for genus; punctate; ischial suture well defined along length, deep, narrow.

Sternum glabrous except for sparse setae on somites 2–3; well developed concentric striae across somites 2–4 (poorly developed or absent in smaller paratypes), somites 5–8 distinctly punctate; sulcus between somites 2–3 obsolete medially and laterally, formed into broad submedial depressions (sulcus variable in small paratypes); sulcus between somites 3–4 also obsolete medially and laterally, formed into deep broad submedial depressions (poorly developed in small paratypes), well separated from abdominal cavity.

Chelipeds. Smooth; dimorphic (isomorphic in female and small male paratypes). Major cheliped with fingers gaping, pollex dentate along opposing edge, teeth short, blunt, one tooth larger than rest, positioned c. halfway along opposing edge, dactylus similarly dentate with large tooth slightly proximal to that of pollex, pollex strongly tapering in distal half, ventral manus

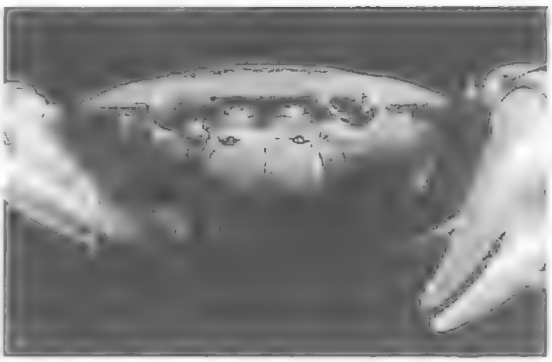

FIG.2. *Holthuisana (Austrothelphusa) tigrina* sp.nov., holotype ♂ (35.4mm CB), QMW18822. Carapace frontal view.

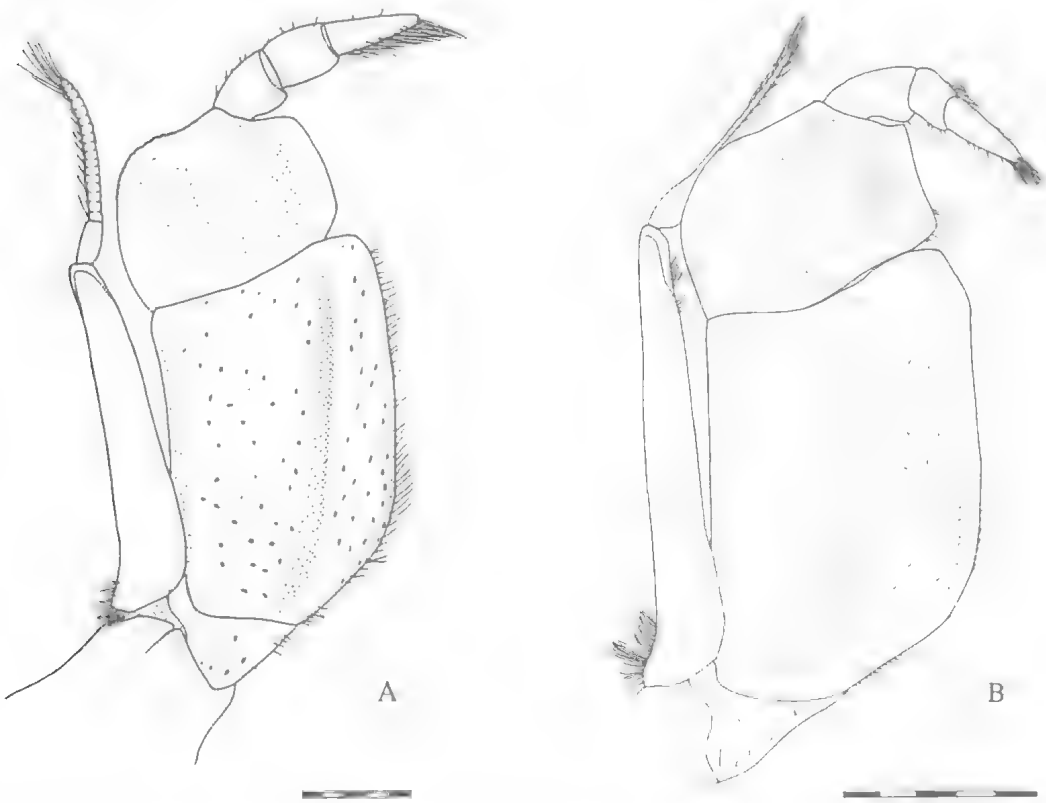

FIG.3. A, *Holthuisana (Austrothelphusa) tigrina* sp.nov., paratype ♂, QMW17162; B, *Holthuisana (Austrothelphusa) transversa* (Martens, 1869), QMW11331, Mt Leonard Stn, SWQ. Third maxilliped. Scale divisions in millimetres.

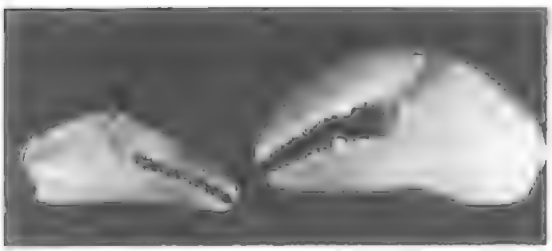

FIG.4. *Holthuisana (Austrothelphusa) tigrina* sp.nov., holotype ♂, QMW18822. Chelipeds.

longer than pollex, dactylus slightly arched, carpus with large dorsomesial spine and smaller ventromesial spine, merus with subterminal transverse groove dorsally and subterminal transverse carina ventrally. Minor cheliped with fingers slender, touching on distal half, both fingers bearing small teeth, pollex length equal to length of ventral manus, carpus and merus similar to major cheliped

Abdomen. Abdomen punctate; tapering abruptly from third to fifth segments; first three segments very broad; abdomen length c.1.2 x basal breadth (1.0 - 1.2 in paratypes); telson damaged (bell-shaped, length about equal to breadth in male paratypes); penultimate segment damaged (breadth c.1.3-1.5 x length in male paratypes). Pleopods without unique features for subgenus.

COLOUR

Carapace tan with conspicuous black markings persistent after alcohol preservation; transverse

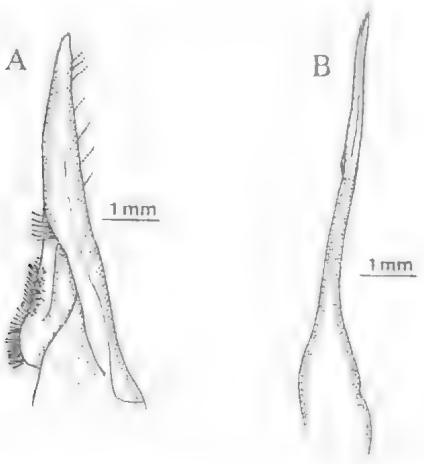

FIG.5. *Holthuisana (Austrothelphusa) tigrina* sp.nov., holotype ♂, QMW18822. A, ventral left first pleopod; B, ventral left second pleopod.

FIG.6. *Holthuisana (Austrothelphusa) tigrina* sp.nov., paratype ♂ (36.0mm CB), QMW17162. Sternum and abdomen.

epigastric band, pair of anterolateral bands, metagastric band (occasionally interconnects with anterolateral bands), two pairs of posterolateral blotches, and an intestinal blotch. Chelipeds cream with black distal band on merus, carpus, and superior palm; superior carpus and fingers tinged with purple. Merus of ambulatory legs yellow, distal segments purple. Eyestalks with mesial, longitudinal, black stripe.

BIOLOGY

The new species was collected from a small seasonal creek, c.200km from the sea. This creek only flows during the wet season (November to April), at which time the crabs number in their thousands in shallow water (L. Bulley, pers.comm.).

Gordon Staples has observed that during the wet season the crabs are relatively docile when handled and are very active during the day. Aquatic predators are absent and they are often very conspicuous on clean sandy substrates where their colour pattern is of little value for camouflage. In the dry season they occupy sandy burrows amongst the roots of fringing paperbark trees (*Melaleuca* sp.). Other freshwater crabs occur in the same area but are much rarer and are seen in the order of one specimen for every 100 specimens of the new species (one small specimen of *H. (A.) agassizi* was collected with paratypes of the new species by G. Staples).

H. (A.) tigrina was first introduced to the Sydney aquarium trade in 1991. It has since sold steadily under the market name 'tiger crab' along with another freshwater crab marketed as the

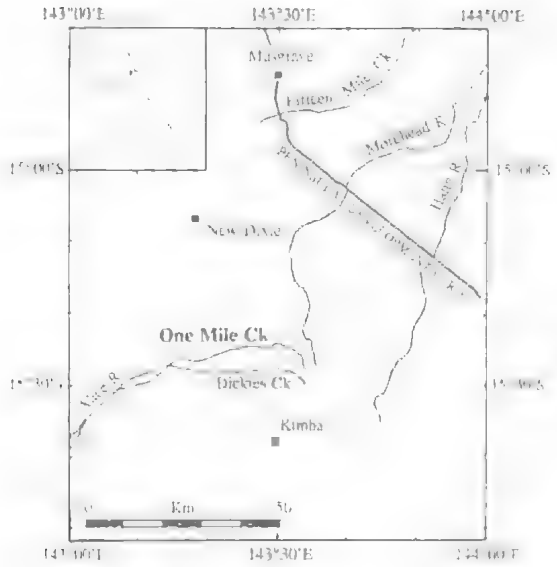

FIG.7. Location of One Mile Ck, the type locality of *Holthuisana (Austrothelphusa) tigrina* sp.nov.

'porcelain crab' (N. Haliwell, pers.comm). The 'porcelain crab' from the Reedy St George River north of Mt Carbine is an interesting variant of *H. (A.) agassizi* (Rathbun,1905) in which the broad, centrally-constricted, median carapace band, often seen in the species, is very clearly defined and unmottled.

DISTRIBUTION

Known from the type locality, One Mile Creek, a tributary of the upper Alice River, Mitchell River catchment (Fig.7).

ETYMOLOGY

Latin *tigrinus*, spotted like a tiger, and referring to the conspicuous black markings on the carapace and chelipeds.

SYSTEMATIC POSITION

The new species is most similar to *H. (A.) transversa* (Martens,1869), and differs from other Australian species in the following combination of characters: anterolateral regions of the carapace lacking distinct striations, not inflated, and without a distinct anterolateral tooth; frontal margin of carapace slightly concave or straight; carapace moderately deep, depth about half maximum carapace breadth.

H. (A.) tigrina can be distinguished from *H. (A.) transversa* by: the telson being as long as broad whereas in *H. (A.) transversa* it is distinctly broader than long; the median suture on the ischium of the third maxillipeds much narrower and more sharply defined; the inferior orbital angle distinctly crenulate whereas in *H. (A.) transversa* it is entire; the carapace much narrower, breadth c.1.25 x CL as opposed to c.1.40 in *H. (A.) transversa*, and less strongly convex longitudinally; posterolateral carapace margins converging much more strongly in *H. (A.) transversa*; the eyes much larger with the eyestalks distally expanded to accommodate the large cornea in the new species.

The distinctive striped colouration of *H. (A.) tigrina* sp.nov. also readily distinguishes it from *H. (A.) transversa*, and other Australian species.

SURVIVAL STATUS

Vulnerable, due to its apparently restricted distribution. Although reportedly abundant during the wet season in One Mile Ck, the area is currently leasehold pastoral land and lies largely within the Alice River Mining Field (T. Pratt, Cook Shire Council, pers.comm.). Gold mining is a foreseeable threat to the habitat of the species.

ACKNOWLEDGEMENTS

I am indebted to Leigh Bulley for bringing this interesting crab to my attention and donating live specimens to the QM. Mr G. Staples provided biological information and additional specimens from the type locality, as well as material of the 'porcelain crab'. Mr Norm Haliwell, Riverside Aquariums gave details on the marketing of the species in Sydney. Peter Davie of the Queensland Museum is thanked for his constructive comments on the manuscript. Tina Pratt, Cook Shire Council, provided information on current land zoning of One Mile Ck. Jeff Wright and Gary Cranitch printed the photographs.

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AN ECOLOGIC AND BIOGEOGRAPHIC STUDY OF A NEW TERTIARY LAND SNAIL FROM MIDEASTERN QUEENSLAND (PULMONATA: CARYODIDAE)

JOHN STANISIC

Stanisic, J. 1994 06 01: An ecologic and biogeographic study of a new Tertiary land snail from mideastern Queensland. (Pulmonata: Caryodidae). *Memoirs of the Queensland Museum* **35**(1): 241-247, Brisbane. ISSN 0079-8835.

A new fossil land snail, *Praecaryodes antiquata* gen.et sp.nov., is described from the Middle to Late Eocene deposits of the Rundle Formation, near Rockhampton, mideastern Queensland. The species is assigned to the Caryodidae. The phyletic, biogeographic and ecological implications of this discovery are discussed. The new species suggests early diversification of the Caryodidae. □*Mollusca, Caryodidae, Praecaryodes antiquata sp.nov., ecology, biogeography, Eocene, land snail.*

John Stanisic; Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; 14 February 1994.

Few Australian fossil land snails are known and most are from Pliocene-Pleistocene sediments of southern Australia (e.g.Strzelecki, 1845; Johnston, 1880; Ludbrook, 1978, 1984). McMichael (1968) recorded *Meracomelon lloydi* from the Carl Creek limestones of north-west Queensland and the Northern Territory; Kershaw (1988a) discussed several fossil land snails of problematic affinity from Pleistocene deposits in the Kent Group of islands, Bass Strait; and Hill et al. (1970) recorded *Pedinogyra* sp. (family Caryodidae) from a limestone quarry at Marmor, south of Rockhampton, mideastern Queensland (hereafter MEQ). The discovery of *Praecaryodes antiquata* gen.et sp.nov. in Middle to Late Eocene deposits of MEQ is a significant addition to the Australian fossil land snail fauna.

The age of the fossil and its relationships to the extant Gondwanan family Caryodidae provide a basis for biogeographic speculation about the evolution of land snails in eastern Australia. The climatic and habitat shifts which have occurred in eastern Queensland since the early Tertiary have favoured the development of dry-adapted species. This provides an ecological framework for discussing caryodid history in the region.

All material studied is in the collections of the Queensland Museum (hereafter prefixed QMF).

STRATIGRAPHY, AGE AND PALAEOENVIRONMENT

The Narrows Beds (Fig. 1), NW of Gladstone, MEQ, which include the Curlew and Rundle Formations and Worthington Beds (Henstridge and Missen, 1982) are a Tertiary non-marine sequence containing oil shale seams. These richly fossiliferous beds contain ostracods (Beasley, 1945), fish (Hills, 1943), reptile fragments (crocodile and turtle) and flora (Foster, 1979; Foster & Harris, 1981; Rowett, 1988). Freshwater gastropods (?Planorbidae) are common in some units (Coshell, 1983). The land snail remains were contained in the Claystone Unit of the Ramsay Crossing Seam within the Rundle Formation.

Little data are available to independently correlate the Tertiary Basins of central and northern Queensland and most age determinations are based on long distance correlation with Tertiary sequences in Southern Australia. It has yet to be demonstrated that the northern Australian Tertiary floras can be conveniently reconciled with known spore-pollen ranges from southeastern Australia. Given these shortcomings, the most recent age estimate of the Rundle Formation is Middle to Late Eocene (Day et al., 1983).The depositional environment of the Ramsay Crossing Seam was interpreted as shallow lacustrine with lacustrine and pedogenic phases (Coshell, 1983).

Occurrence of land snails among the predominantly freshwater fossil remains suggests that they are drift material which has been washed into the lagoon from surrounding areas. Henstridge & Missen (1982) postulated a similar mechanism to explain the high levels of carbonaceous matter among the oil shale.

Information on the contemporaneous vegetation present in the area surrounding the Rundle Formation depositional environment is not available. However, the presence of large amounts of carbonaceous material in the oil shales and the

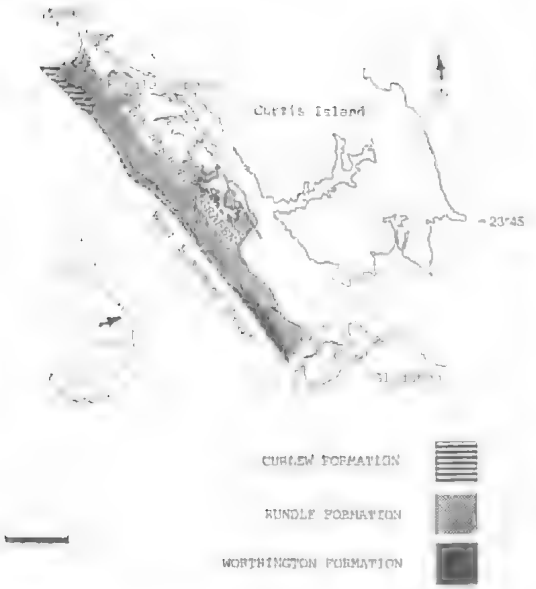

FIG. 1.Locality map showing the Rundle Deposit and the Tertiary stratigraphic units in the Narrows Group. Map adapted from Henstridge & Missen (1982). Scale line = 1km.

inference of high rainfall and humidity (Henstridge & Missen, 1982) suggest a tropical to subtropical closed forest. Fossil flora of the younger Curlew Formation indicates deposition in a low energy, freshwater swamp in an area of marginal tropical/subtropical closed forest. These interpretations correlate with a broader perspective of vegetational change in eastern Australia during the Eocene (Kemp, 1981) pointing to a widespread closed-canopy rainforest early in the epoch, becoming more restricted (i.e. replaced by sclerophyllous elements) in the Middle to Late Eocene when climate began to fluctuate.

SYSTEMATIC PALAEONTOLOGY

Family CARYODIDAE Thiele, 1926

Australian acavoid land snails have been traditionally associated with the mesurethran family Acavidae which also included a number of species from Africa, India and South America (Zilch, 1959-60). Solem (1978a) separated the Australian genera as a separate family, the Caryodidae, and placed it and the Acavidae near the more advanced sigmurethran pulmonates. Tillier (1989) rejected this arrangement in favour of a single family. Smith (1984, 1992) also preferred to consider the Australian species as a distinct family and this system is followed here.

The Caryodidae includes an unusual mix of shell types ranging from the depressedly conoidal *Anoglypta* Martens, 1860 and giant bulimoid *Hedleyella* Iredale, 1914 to the lenticular, thin-shelled *Pandofella* Iredale, 1933 and the flat-coiled, heavy-shelled *Pedinogyra* Albers, 1860. This led Iredale (1937) to place these genera in several different family units. Only thirteen extant species are known (Smith, 1992). All live in the moist forests of eastern Australia.

Praecaryodes gen.nov.

DIAGNOSIS

Shell large and subglobose with a flattened spire. Shell sculpture predominantly radial with weak spiral grooves on the body whorl. Umbilicus absent. Aperture ovate; lip thickened and reflected.

TYPE SPECIES

Praecaryodes antiquata sp.nov.

ETYMOLOGY

A combination of the Latin *prae* meaning early and the nominate genus of the family Caryodidae.

Praecaryodes antiquata sp.nov. (Figs 2-5)

MATERIAL EXAMINED

HOLOTYPE: QMF13905, Rundle, MEQ. Collected by Southern Pacific Petroleum, August, 1985.

PARATYPES: QMF13451, QMF17642, 2 specimens. Unit T claystone, Ramsay Crossing Seam, Rundle Formation, MEQ, open cut, L. Coshell.

ETYMOLOGY

Referring to the antiquity of the specimen.

DESCRIPTION

Shell large (damaged and distorted), subglobose, diameter 41.94mm with 4¾ normally coiled whorls, the last greatly expanded and not descending in front. Spire and apex flat. Height 28.30mm. Height of body whorl 21.62mm. Protoconch 2 whorls, sculptured with fine, crowded, weakly protractively sinuated radial ribs. Post nuclear sculpture of numerous, fine, protractively sinuated radial ribs, becoming

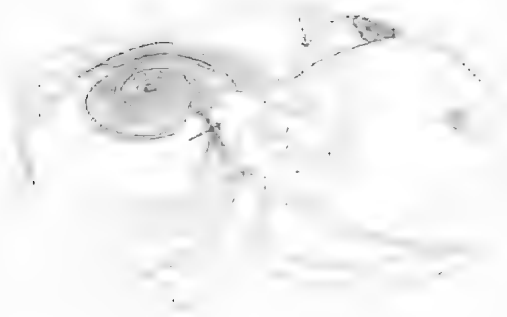

FIG. 2. *Praecaryodes antiquata* sp.nov., QMF13905, holotype. Drawing to show depressed shape and thickened lip (arrowed).[Drawing by Alison Hill].

slightly less conspicuous on the body whorl, and irregularly spaced spiral grooves which are particularly noticeable on the body whorl. Umbilicus absent. Sutures weakly impressed. Whorls flattened above and below a weakly keeled periphery. Aperture ovate. Lip strongly thickened and reflected. Columella inserted obliquely. Parietal callus obscured.

REMARKS

In spite of the small amount of the material available for study, sufficient features are present to make familial placement possible. The flattened spire, sculpture, coiling pattern, whorl expansion rate and reflected lip relate *P. antiquata* to the Caryodidae, in particular the flat-coiled *Pedinogyra*. However, the absence of an umbilicus is a major departure from this genus and indicates a possible connection with the bulimoid caryodid genera. In Tasmania a few examples of the bulimoid form do have an umbilicus and occasionally, juveniles have an umbilicus which is lost with growth. This may indicate that an umbilicus was more common in ancestral forms of these species and that the non-umbilical lineage of *Praecaryodes* is distinct from these.

Sphaerospira Mörch, 1867 (+*Figuladra* Iredale, 1933, *Varohadra* Iredale, 1933 and *Bentosites* Iredale, 1933) (family Camaenidae) have numerous species living in the rainforests of southeastern Queensland (hereafter SEQ) and MEQ (Smith, 1992). These genera also have globose to subglobose shells which often lack an umbilicus. However they have almost obsolete adult sculpture, smooth protoconch, less expanded body whorl and weakly reflected lip. *Xanthomelon* Martens, 1861 (family Camaenidae), from the drier vine thickets of eastern Queensland, has a large, globose shell without an umbilicus and with conspicuous cancellate sculpture on the body whorl. However the protoconch is smooth and most importantly, the lip is not reflected.

Biogeographically, these eastern Australian camaenids are considered to be post-Miocene northern immigrants (Bishop, 1981), hence appearing in the region much later than *P. antiquata*.

DISCUSSION

The Middle to Late Eocene age of *P. antiquata* represents a marked chronological extension of the fossil record of land snails in Australia and significantly predates previous records (Pliocene/Pleistocene). The presence of a reflected lip, a probable derived character within the Caryodidae, has important implications for the timing of the first appearance of the family on the Australian land mass.

A brief reappraisal of the relationships of extant caryodid genera is a necessary preamble to biogeographic considerations.

CARYODID RELATIONSHIPS

Caryodids have an unusually diverse array of shell form yet Dartnall & Dartnall (1972) concluded that the genera were closely related on the basis of karyotype and reproductive anatomy. Their results segregated the Tasmanian *Anoglypta* and *Caryodes* Albers, 1850 from the mainland *Pygmipanda* Iredale, 1933, *Hedleyella* and *Pedinogyra*. Two remaining mainland genera - *Brazieresta* Iredale, 1933 and *Pandofella* -were not included in their study. Kershaw (1988a,b), utilising fundamental features of shell morphology, substantially agreed with this interpretation.

The separation of *Anoglypta* and *Caryodes* from mainland caryodids is supported by protoconch features. The nuclear sculpture of the Tasmanian genera is characterised by distinct spiral cords which are irregularly and weakly cut into long segments by radial grooves (Kershaw, 1988 a,b). Mainland caryodids have more regular decussate apical sculpture. In *Brazieresta* and *Pandofella* this decussate nuclear sculpture is almost granular. These genera have thin, reduced shells and anatomical features consistent with an evolutionary move to slugdom. This may indicate a close relationship between them even though *Pandofella* has a genital diverticulum positioned similarly to that of *Anoglypta* (Stanisic, unpubl.).

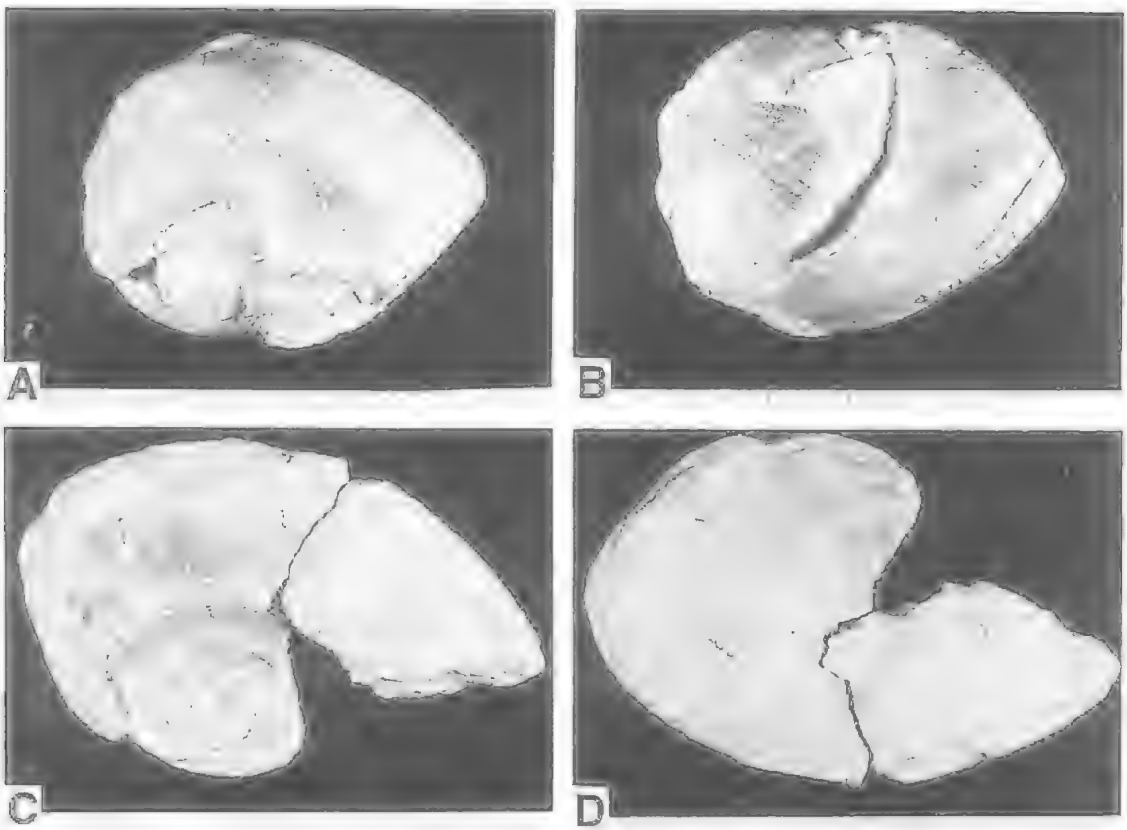

FIG. 3.*Praecaryodes antiquata* sp.nov. A-B, QMF13905, Rundle, MEQ, holotype; C-D, QMF17642, Rundle Formation, MEQ, paratype (internal cast). Scale units in mm.

Solem (1978a) showed that arrangement of internal structures in slug-like taxa were often related to spatial readjustments resulting from a reduction in the visceral hump rather than representing primary phylogenetic changes. *Brazieresta* and *Pandofella* survive in cool moist, upland refugia in northern NSW (*Brazieresta*) and MEQ respectively and possibly represent highly specialised, temperate relicts of a single (monophyletic) lineage within the family.

Pygmipanda, *Hedleyella* and *Pedinogyra*, display shell features which indicate a long period of development by each under different ecological regimes. *Pygmipanda* lives in the moist, warm to cool, temperate forests of central and southern New South Wales (NSW) and Victoria; *Hedleyella* in the warm temperate and warm humid subtropical forests of northeastern NSW and SEQ; and *Pedinogyra* in the drier araucarian microphyll vine forests and semi-evergreen vine thickets of northeastern NSW, SEQ and MEQ. Shell form indicates specialisation to different adaptive zones.The reduced sculpture, low whorl numbers, inflated body whorls and large apertures of *Hedleyella* and *Pygmipanda* are adaptations consistent with life in humid, moist forest. In contrast the heavy and flat shell of *Pedinogyra*, with small, downwardly directed aperture and higher whorl numbers is adapted for life in a dry-forest habitat.

Conchologically the position of *Pedinogyra* is the most difficult to reconcile within the caryodids. The discoid shape, wide umbilicus, heavy shell with thickened lip and strong radial apical sculpture are features which stand at odds with those of the other genera. Nonetheless, Kershaw (1988b) emphasised that *Pedinogyra* was a derived bulimoid taxon, citing the transition series within *Hedleyella* i.e. imperforate bulimiform [*H. maconelli* (Reeve, 1853)] to umbilicate, globose, sub-auriform [*H. falconeri* (Gray, 1834)] as a means of deriving a flat-coiled

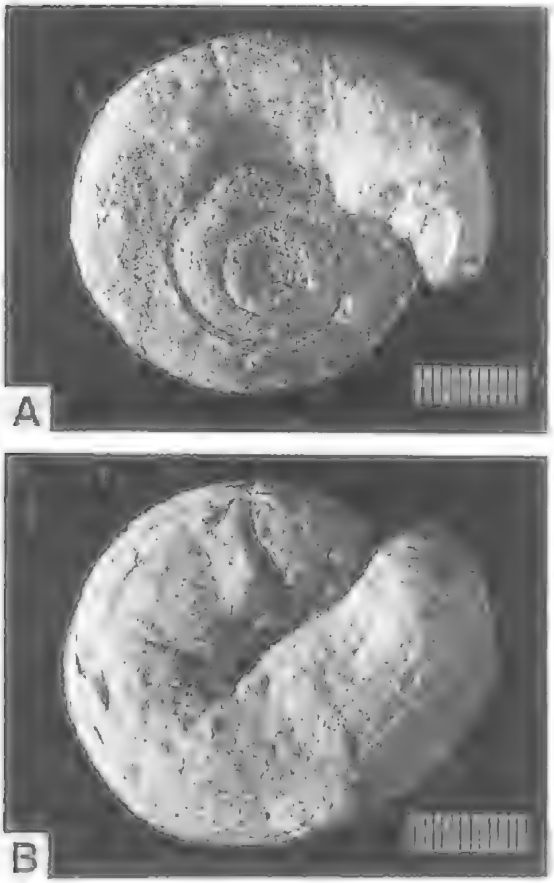

FIG. 4.*Praecaryodes antiquata* sp.nov. QMF13451, Rundle Formation, MEQ, paratype (internal cast). A, top view; B, bottom view. Scale units in mm.

shell from the more generalised bulimoid form. However, one feature of *Pedinogyra* which is not easily explained in the context of general caryodid patterns is the thickened reflected lip.

P. antiquata possesses features which are transitional between the bulimoid caryodid forms and *Pedinogyra* - a depressedly globose bulimoid shell with small aperture and thickened, reflected lip. The latter character, rare within extant forms, indicates a possible close relationship with *Pedinogyra*. *P. antiquata* may be the moist forest ancestor of these modern-day, flat-coiled caryodids.

Caryodid Fossil History

Comparatively little information is available on other caryodid fossils. Hill et al. (1970) recorded a species of *Pedinogyra* from Pleistocene limestone deposits at Marmor, south of Rockhampton, MEQ. Subfossil *Pedinogyra*, possibly Pleistocene in age are also known from the Cammoo and Olsen Caves, north of Rockhampton, MEQ (Stanisic, unpubl.). These are all considered to be conspecific with an extant species, *Pedinogyra minor* (Mousson, 1869) (=*nanna* Iredale, 1937), which lives in the region.

Kershaw (1988a) discussed a fossil land snail from the calcareous beds (?Pleistocene) of the Kent Group of islands, Bass Strait, which may be related to *Pedinogyra*. Inspection of the shell (Queen Victoria Museum, Launceston - QVM:87.G.163) reveals an overall resemblance to *Pedinogyra*. However, compared with that genus, it has fewer whorls, smaller umbilicus and vague traces of regularly spaced incised spiral lines cutting across fine radial ribs on the last ¼ whorl. The resulting cancellate pattern is not equivalent to that seen in extant caryodids but is more commonly associated with the shells of carnivorous Rhytididae. Although the peripheral keel of the Tasmanian fossil is not present in any living Australian rhytidid, it is possessed by several New Zealand species of that family.

Biogeographic Implications

The presence of a number of derived caryodid features (pronounced radial sculpture and thickened, reflected lip) in *P. antiquata* indicates that the adaptive radiation of the Caryodidae in central eastern Australia was probably completed much earlier i.e. beginning of the Tertiary or possibly Late Cretaceous. This would place familial origins contemporaneously with the emergence of the advanced, sigmurethran camaenids in northern land masses (Solem, 1978b). Hence rather than being ancestral to the helicoid sigmurethrans, the caryodids (and probably acavoids of Africa and India and South

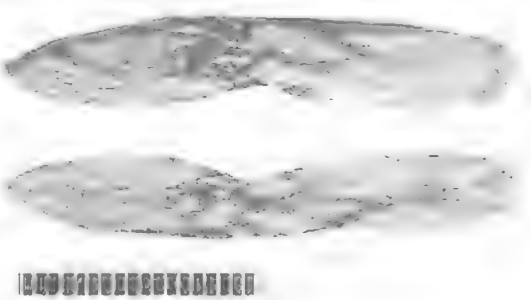

FIG. 5.*Praecaryodes antiquata* sp.nov., QMF13451, paratype. Sectioned to show internal structure. Scale units in mm.

America) may represent an equivalent and parallel level of snail evolution in southern land masses.

Ecological Implications

The impetus for the initial radiation of the caryodids on the Australian land mass would have been enhanced by the significant change in the nature of the flora from one dominated by conifers to one with a significant angiosperm component at the Cretaceous/Tertiary boundary. (Kershaw et al., 1991). The switch to a broad-leaved, closed-forest with a propensity for greater leaf fall would have favoured 'moisture-loving' snails by providing a new adaptive zone of leaf litter with moist to humid micro-environments and shelter. Subsequent distribution of the family in eastern Australia would have been greatly influenced by the climatic and vegetational changes that took place in the latter part of the Tertiary and Quaternary (Kemp, 1981; Kershaw, 1981). The diversification of eastern Australian rainforest into temperate, tropical and subtropical forms had its beginning in the Mid-Eocene (Kershaw et al., 1991). With the onset of the Miocene aridity phases 'drier' subtropical rainforest developed where edaphic profiles were suitable and in the late Tertiary and Quaternary, mesothermic elements in the north were confined to montane refugia.

P. antiquata lived in conditions which were wetter and cooler than MEQ today. Vegetation was dominated by *Nothofagus* forest types (Kemp, 1981), a conclusion supported by palynological evidence from the Rundle deposits (Foster, 1979). Significantly *P. antiquata* displays some shell characters (comparatively thin shell, more conspicuous sculpture) which today are found in *Pedinogyra rotabilis* (Reeve, 1852) and *P. effossa*. These species live in marginally wetter areas (Border Ranges, Conway and Clarke Ranges respectively) at the periphery of the main mass of *Pedinogyra*.

Creation of the Fitzroy dry corridor would have considerably changed conditions in the Rockhampton - St Lawrence region and although refugia in MEQ (Sarina - Proserpine) enabled caryodids to survive [*Pedinogyra effossa* Iredale, 1937; *Pandofella whitei* (Hedley, 1912)] this drastic local change in environment probably led to the extinction of *P. antiquata*. Subsequent conditions would have favoured the development and dispersal of the comparatively dry-adapted, thicker, smoother shelled *Pedinogyra hayii* (Griffith & Pidgeon, 1933) - *P. allani* Iredale, 1937 - *P. minor* in the araucarian vine forests of southeastern Queensland (with *P. minor* replacing *P. antiquata* in the drier areas of the Gladstone - Rockhampton region).

The colonising wave of northern camaenids (*Sphaerospira* s.l.) would have been able to take advantage of occasional later climatic shifts to wetter conditions and now occupy the microhabitats most probably favoured by *P. antiquata* in the past.

CONCLUSIONS

The discovery of *Praecaryodes antiquata* in the sediments of the Rundle Formation has important implications for understanding the evolution of the Caryodidae in eastern Australia. Shell features of this taxon indicate early diversification of the family on the Australian land mass which rivals the appearance of the camaenids in Laurasia. Climatic change since the Miocene not only led to the extinction of *P. antiquata* but also profoundly affected the evolution of the family which displays a preference for moist forests. The colonisation of the eastern Australian rainforests by camaenids from the Papua New Guinean region most likely usurped the adaptive zone (microhabitat) previously held by *Praecaryodes*.

ACKNOWLEDGEMENTS

Thanks are due to ESSO (Australia) and their joint venture partners Southern Pacific Petroleum and Central Pacific Minerals for making the material available for study. Lee Coshell (ESSO) provided stratigraphic data for the paratype material. The assistance of Ron Kershaw, Queen Victoria Museum, Tasmania in providing comparative fossil material is gratefully acknowledged. The author is especially indebted to Andrew Rozefelds for bringing the material to his attention and for providing data and figures on the stratigraphic elements of the paper. The Queensland Museum Photography Section processed photographic illustrations. Finally thanks are due to Jennifer Mahoney for typing the manuscript.

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THE IMPORTANCE OF RIPARIAN HABITATS TO VERTEBRATE ASSEMBLAGES IN NORTH QUEENSLAND WOODLANDS. *Memoirs of the Queensland Museum 35(1):248. 1994.*:- Northern Australia is characterised by large areas of seasonally dry eucalypt woodland with riparian systems forming a network of narrow strips of relatively mesic habitat within the drier forests. It is generally accepted that riparian habitats are vital to these ecosystems. Riparian vegetation is generally more structurally and floristically diverse than the surrounding woodland and could be expected to contain a more diverse and abundant fauna. The Australian wet/dry tropics has high seasonal variability in resource abundance as a result of the climatic differences between the hot wet summers and dry winters. Riparian systems within this ecosystem are likely to be vitally important in providing water, shelter and food for fauna, especially during the dry season. This paper is meant to be suggestive, not conclusive, in an attempt to promote research on riparian systems.

The observations discussed here were made during a vertebrate fauna survey of Dotswood Station to provide baseline information for an environmental impact assessment (Williams et al.,1993).

The study area of 2320 km^2 (Dotswood Station) is situated approximately 50 km south-west of Townsville. Four major sites were chosen (A,B,C & D), each with up to four sub-sites. Site E had no separate sub-sites and was only sampled once. Major habitat types and associated intensive sample sub-sites were as follows:open woodland, A2, A3, B1, B3; open forest, B4, C1, C4, D4; tall open forest/closed forest, D1, D2, D3; riparian, A1, B2, C2, E; rocky outcrops, C3.

The riparian sub-sites A1, B2, and C2 are characterised by dense stands of *Melaleuca leucadendra* often with a mixed shrub layer, while site E consisted of patches of closed *Tristaniopsis exiliflora* gallery forest and more open *Melaleuca leucadendra / Callistemon* spp. forest. Woodland sub-sites were all much more open, drier and less floristically diverse than adjacent riparian sub-sites. The transition from the dense riparian vegetation to the open eucalypt woodland was usually abrupt (approximately 20 metres).

The first faunal survey was conducted between 8 April-3 May 1991 (late wet/early dry season) and the second between 7 August-25 October (late dry season). Each sub-site was sampled by small mammal trapping, pit trapping, observational transects (for birds), spotlighting, active searching and mist netting (bats). For details of site selection, sampling design, techniques and results see Williams et al. (1993)

Most observations indicated a clear difference between the vertebrate species assemblages of riparian sub-sites and sub-sites in the adjacent drier forest. Birds exhibited the most obvious difference between habitats. Riparian sub-sites recorded, on average, 73% of the bird species recorded for the site (excluding water birds), as compared to an average of 35% for dry sub-sites. The average bird species richness of riparian sub-sites (34 species) was significantly greater than at dry sub-sites (17 species) ($F=13.5$, $df=1$, $p=0.0023$). There were 31 species (17% of total) of birds (includes waterbirds) which were exclusively recorded along watercourses, and an additional 26 species (14%) occurred in greater abundance at riparian sub-sites than woodland sub-sites, giving a total of 57 species (31%) of the birds which were at least partly dependent on riparian systems. In contrast, there were only two species of bird observed exclusively at woodland sub-sites.

Differences between sub-sites in the mammal assemblages were less clear. However, Water Rats (*Hydromys chrysogaster*) were observed only at riparian sub-sites, while Greater Gliders (*Petauroides volans*), Brushtail Possums (*Trichosurus vulpecula*), Agile Wallabies (*Macropus agilis*) and Brown Bandicoots (*Isoodon macrourus*) all appeared to be more abundant in riparian vegetation. Fishing Bats (*Myotis adversus*), a species restricted by the availability of free water, were recorded only at two riparian sub-sites.

Five species of reptiles which are restricted to riparian habitats were observed, including one snake (*Tropidonophis mairii*), two lizards (*Physignathus lesueurii* & *Sphenomorphus quoyii*) and two tortoises (*Elseya latisternum* & *Emydura krefftii*). All of the 16 species of frogs were recorded in riparian vegetation while only five species were recorded away from the riparian zone. Most species of frogs were clearly more abundant within the riparian zone.

The results discussed here suggest that vertebrate faunal diversity and abundance is considerably greater in riparian vegetation than in the surrounding habitat. It may seem inane to include exclusively aquatic species, for example fresh water turtles and waterbirds, in this discussion, however these species make a significant contribution to local and regional biodiversity and, as such, highlight the great importance of riparian habitat within this ecosystem.

The conservation and protection of riparian habitats is of paramount importance in preserving the biodiversity of the eucalypt woodlands of northern Australia. The protection of riparian vegetation is also an essential part of any land care program. Woodlands and forests are one of the most widespread and important habitats in Australia, therefore an understanding of riparian systems is necessary to enable the efficient preservation and management of this ecosystem.

It would be interesting to closely examine riparian systems in Australia to investigate whether:

1.riparian habitats contain a higher diversity and abundance of fauna than the adjacent woodlands/forests and thereby make a large contribution to local and regional diversity;

2.there are a significant number of species which are wholly or partly dependent on riparian systems for at least part of the year,

3.higher diversity and abundance is due to a combination of more available niches and more abundant resources, resulting from higher structural complexity and floristic diversity of the riparian vegetation, and a higher and more seasonally stable productivity;

4.riparian systems act as refuges during the dry season and a source of dispersal at the commencement of the wet season: the value as a refuge could be due to shelter, food, water, or breeding/nesting sites;

5.riparian habitats provide seasonally abundant resources such as nectar, insects, water and breeding sites which are vital to much of the biodiversity of these ecosystems;

6.riparian strips can act as corridors for species which find open, dry habitats a barrier to dispersal; and

7.the roles of riparian habitats increase in importance with the general aridity of the area.

Acknowledgements

I wish to thank Prof. Helene Marsh and Dr Richard Pearson for commenting on an early draft of this paper and Scott Berren for assisting in the field work. The study was funded by the Department of Defence through a contract with the Australian Centre for Freshwater Research.

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Steve Williams, Department of Zoology, James Cook University, Townsville, Queensland 4811, Australia; 18 October 1993

THE SUMMER WHITING FISHERY IN SOUTHEAST QUEENSLAND.

A.J. THWAITES AND L.E. WILLIAMS

Thwaites, A.J. & Williams, L.E. 1994 06 01: The summer whiting fishery in southeast Queensland. *Memoirs of the Queensland Museum* 35(1): 249-254. Brisbane ISSN 0079-8835.

The summer whiting (*Sillago ciliata* and *S. analis*) catch from 12 recreational fishing clubs in SE Queensland and the whiting (all species) catch of the commercial fisheries between Caloundra and Southport is assessed. Five popular summer whiting fishing locations (Inskip Point, Bribie and Moreton Islands, Jumpinpin and Southport) were chosen to determine if changes in the yearly mean weight (YMW) and yearly mean catch per person per day (YMC) of summer whiting caught by club recreational fishers had occurred from August to February, 1959 to 1991. It is hypothesised that the summer whiting fisheries are stable at these locations except at Bribie Island where it is declining. □ *Sillago ciliata, S. analis, whiting, catchrates, southeast Queensland.*

Andrew Thwaites & Lew Williams, Fisheries Services, Department of Primary Industries, GPO Box 46, Brisbane, Queensland 4001, Australia; 1 December 1993.

Sillago ciliata (Sand whiting) and *S. analis* (Golden-lined whiting) (Sillaginidae) both have the common name 'summer whiting'. *S. ciliata* is found along the east coast from Cape York to eastern Victoria and along the east coast of Tasmania (McKay,1985). *S. analis* occurs across northern Australia from Shark Bay, W.A. to Moreton Bay and along the east coast of New Guinea (McKay,1985).

S. ciliata grows to a maximum length of 51cm, while *S. analis* grows to a maximum length of 45cm (McKay,1992). Anecdotal evidence (Grant,1987; Davis, pers. comm.; Tebbutt, pers. comm.) suggests that *S. ciliata* grows to a larger mean size and weight than *S. analis* in SE Queensland. The minimum legal size of summer whiting for all fishers is 23cm total length.

Southeast Queensland has many popular recreational fishing locations for summer whiting. Club anglers and others targeting summer whiting commonly fish from Inskip Point to the south of Tin Can Bay, Bribie Island in the NW part of Moreton Bay, Moreton Island to the E of Brisbane, Jumpinpin to the S of North Stradbroke Island and Southport to the S of South Stradbroke Island. Inskip Point and Bribie Island are considered to be primarily summer whiting fisheries while Moreton Island, Jumpinpin and Southport have mixed fisheries with catches of bream (Sparidae), summer whiting and flathead (Platycephalidae). A tag and release study by Morton (1982) showed that spawning *S. ciliata* rarely move more than 5km from the initial point of capture during August to February. Pollock & Williams (1983) in a study of the recreational summer whiting fishery at the southern end of Bribie Island and Moreton Island, hypothesised that this lack of movement continued throughout the year with the population on Bribie Island remaining separate from the population on Moreton Island. Their study concluded that at both locations yearly CPUE (fish per person per day) had increased. They concluded that this rise was probably due to improvements in angling equipment and techniques. The study found no evidence of change in mean weight of summer whiting at Moreton Island. They found that the mean weight of summer whiting had declined at Bribie Island concluding that the decline was due to a rise in fishing pressure.

In 1992, commercial fishermen, netting from ocean and inside beaches between Bribie Island and Southport (Queensland), caught c. 30 tonnes of whiting (all species) between August 1992 and February 1993 (Queensland Fisheries Information System (SUNFISH)). A creel survey of recreational angler catches by Morton (1982) showed that *S. ciliata* account for c.97% and *S. analis* c.1% of the catch on Bribie Island. Pollock & Williams (1983) stated that *S. ciliata* was the only whiting caught on Moreton Island. No study has determined the species composition of the recreational catch at Inskip Point, Jumpinpin or Southport or the commercial catch in the study area. But as the commercial net and recreational fishers fish the same areas, their catches should be similar. Morton's (1982) creel survey suggests therefore that the bulk of the net fishers whiting catch will be summer whiting.

Only a few studies acknowledge that recreational fisheries have just as important an effect on a population of fish as the commercial fishery

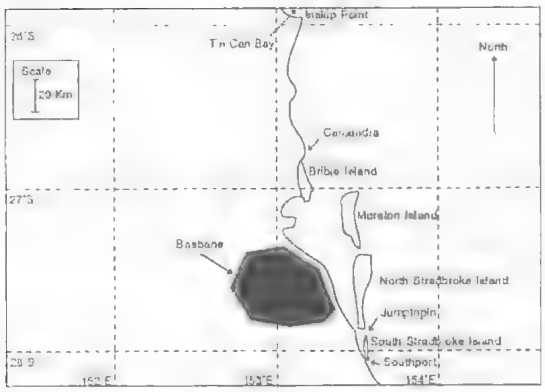

FIG. 1. Locality map.

(e.g. Pollock,1979; Quinn & Pollock,1992). This study will utilise the summer whiting catch records of 12 recreational clubs and historical catches of all whiting species by the commercial fisheries in an attempt to gauge the 'health' of the summer whiting fisheries in SE Queensland. Recreational fishing data allow determination of the mean weight of summer whiting. Commercial whiting catches from Caloundra to Southport will be analysed with emphasis on the net fishery from 1988–1991.

METHODS

Sources of Data

Recreational fishing clubs provided individual fisher catch records from competitions. Data were entered into a database where for each fisher the date, location, numbers of each species caught (e.g. whiting, bream, flathead - catch records do not differentiate between the individual species of whiting) and total weight of catch were recorded.

Commercial fishing records came from: The Fish Board (1959–1972), Queensland Fish Board (1973–1981) and the SUNFISH database (1988–1991). No data were available for 1982–1987. Fish Board and Queensland Fish Board data have been criticised for their reliability (Grey & Spencer,1986). However they are the only data available for this period and should be viewed as indicative of the level of catch.

Study Locations

Five popular recreational fishing locations chosen were: Inskip Point, southern Bribie Island, Moreton Island, Jumpinpin and Southport (Fig.1). Commercial fisheries data were for whiting (all species) between Caloundra and Southport (Fig.1). Commercial trawl data for 1988–1991 were limited to Moreton Bay to remove data collected about the stout whiting

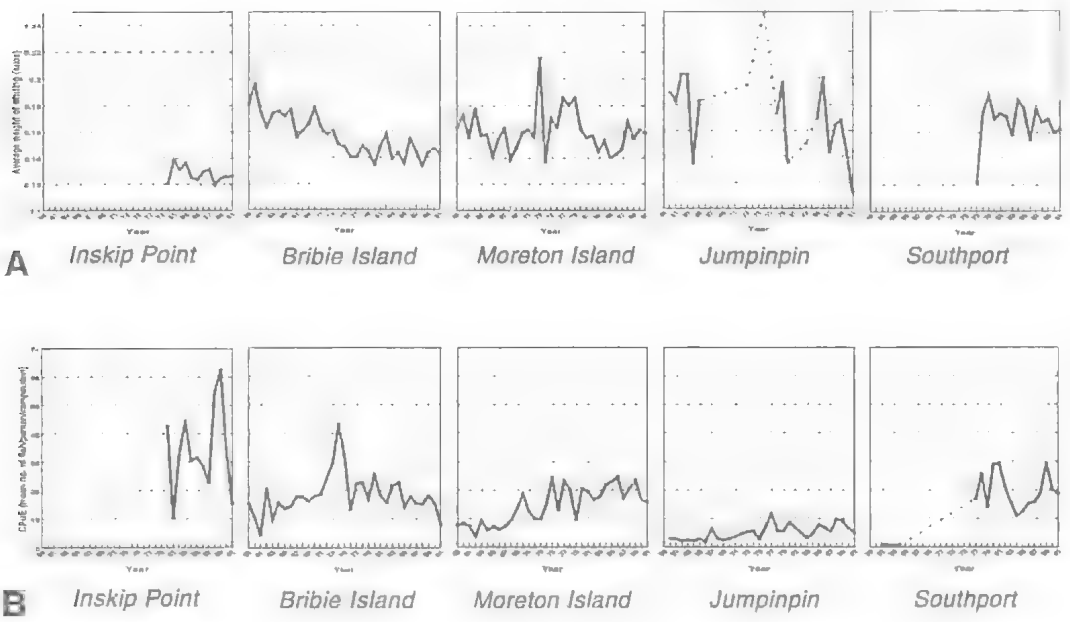

FIG. 2. A, Yearly mean weight (YMW); B, Yearly mean catch (YMC), at each location.

TABLE 1. Results of the linear regression analysis on the YMW of summer whiting.

	Period (n)	R^2	Signif. level
Inskip Pt	80-91 (12)	0.0328	0.2684
Bribie Is	59-91 (33)	0.6844	0.0000
Bribie Is	72-91 (20)	0.1234	0.0713
Moreton Is	59-91 (33)	-0.0210	0.5625
Jumpinpin	60-91 (19)	0.1327	0.0695
Southport	77-91 (15)	-0-0659	0.3106

fishery which started operations in the early nineties and operates outside the areas traditionally trawled for prawns.

Length of Club Competitions

Recreational fishing competitions lasted for less than 24 hours in all cases. Competitions were held at night for all locations except Bribie Island and Inskip Point where the competitions were held during the day. Night time competitions last 12–15 hours, daylight competitions 8–10 hours.

Calculation of Yearly Mean Weight and Yearly Mean Catch

Yearly mean weight (YMW) of fish caught at each location was calculated by dividing the total weight of summer whiting caught by fishers in each year by the total number of summer whiting caught by fishers that year. The only whiting records used in the YMW calculation were those where both the number of fish and weight of whiting caught were recorded. The yearly mean catch (YMC) at each of the locations was calculated as the mean of the number of fish caught per fisher per day (CPUE).

Time for the Study

August to February,1959–1991; total yearly commercial catch of whiting (all species) for 1959–1991, except for 1982–1987 where no data were available, was analysed as total monthly catches were not available for most years.

TABLE 2. YMW at each location.

	Period	Av. YMW (kg)	St. dev.	Min weight (kg)	Max. weight (kg)
Inskip	80-91	0.128	±0.006	0.120	0.139
Bribie	70-91	0.146	±0.008	0.134	0.161
Moreton	59-91	0.160	±0.016	0.137	0.216
Jmp'pin	59-91	0.174	±0.015	0.113	0.250
S'port	77-91	0.167	±0.15	0.121	0.187

Sample Sizes

Sample sizes in each year for the calculation of YMW at Inskip Point, Bribie Island and Moreton Island were above 1000 fish. At Jumpinpin and Southport the sample sizes in each year averaged 60 and 600 fish per year respectively with the lowest sample size being 17 fish at Jumpinpin in 1964. Sample sizes for the calculation of YMC averaged above 150 angler days per year at Bribie Island and Moreton Island. Sample sizes at the other 3 locations averaged 40–75 angler days per year with the minimum sample size being 10 angler days at Jumpinpin in 1980.

Statistical Analysis

Linear regressions on YMW and YMC at each location and on commercial whiting catch used Statistix, version 4, by Analytical Software (1992).

RESULTS

Yearly Mean Weight (YMW) of Summer Whiting Caught by Recreational Anglers (Fig.2A)

There is no significant trend in YMW at Southport, Jumpinpin, Moreton Island or Inskip Point whereas it has declined significantly at Bribie Island (Table 1). However there has been no significant trend in YMW at Bribie Island since the early 1970s (Table 1) from which time YMW has averaged c.0.146±0.008kg/fish (Table 2).

Yearly Mean Catch (YMC) of Summer Whiting Caught by Recreational Anglers (Fig.2B)

There is no recognisable trend in YMC at Inskip Point (Table 3). At Bribie Island YMC increased from 1959–1974 then decreased 1975–1991 (Table 3) by c.10 fish/person/day. At

TABLE 3. Results of the linear regression analysis on the YMC of summer whiting.

	Period (n)	R^2	Signif. level
Inskip	80-91 (12)	0.3934	0.0032
Bribie	59-74 (16)	0.5255	0.0009
Bribie	75-91 (17)	0.3217	0.0103
Moreton	59-91 (33)	0.5842	0.0000
Moreton	70-91 (22)	0.1238	0.0602
Jmp'pin	59-91 (30)	0.4118	0.001
Jmp'pin	70-91 (20	0.0979	0.9720
S'port	61-91 (18)	0.3934	0.0032
S'port	77-91 (15)	-0.0659	0.7196

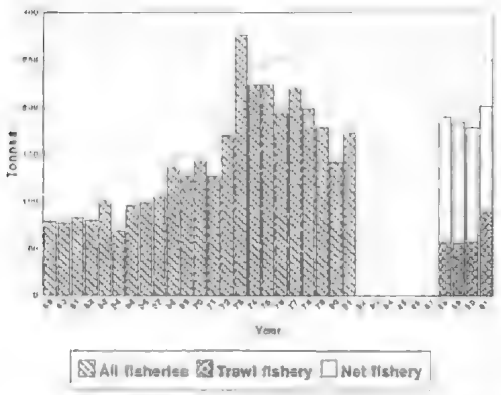

FIG. 3. Yearly commercial catch of whiting (all species) from Caloundra to Southport.

Moreton Island and Jumpinpin there was an overall increase (Table 3) up to 1970 after which it has been stable. At Southport there was an increase (Table 3) from 1959–1991 with no change from 1977–1991. Data are not available for catches at Southport from 1965–1976.

YEARLY COMMERCIAL WHITING CATCHES

The total whiting catch for the commercial fisheries (Fig. 3) shows a significant rise in yearly whiting (all species) catch from 1959–1991 (R-squared 0.4633, Significance level 0.000). However since the early 1970s there has been no significant change in total commercial catch. The commercial catch (1971–1991) averaged c.150 tonnes (min. 142 tonnes in 1980, max. 277 tonnes in 1973).

Catch data for the net fishery 1988–1991 (Table 5) show no significant change in number of days fished or CPUE (kg/day/boat). A decline in the total catch of whiting in the net fishery occurred between 1988–1991 with a yearly decline in catch of around 6%.

TABLE 4. YMC at each location.

	Period	Mean YMC	St. dev.	Min. YMC	Max. YMC
Inskip	80-91	34.3	±14.4	10.4	62.4
Bribie	75-91	18.7	±5.3	8.3	32.14
Moreton	70-91	17.9	±4.7	9.6	24.6
Jmp'pin	70-91	6.2	±2.3	3	11.6
S'port	77-91	19.1	±6.15	11	29.5

DISCUSSION

SIZE OF SUMMER WHITING

The decline in YMW at Bribie Island from 1959–1972 was observed by Pollock & Williams (1983) but our analysis shows this ceased in 1972. The YMW of summer whiting on Bribie Island stabilised in 1972 at 0.146±0.008kg/fish. Possible causes for the decline from 1959–1972 are : 1, increased fishing pressure due to increased number of anglers; 2, increased fishing pressure due to improvements in angling techniques and equipment; 3, population decline of summer whiting due to loss or modification of habitat; 4, natural decline in the population of summer whiting due to weather effects such as fresh water runoff; 5, higher percentage of *S. analis* in the catch, which has a smaller mean weight than *S. ciliata* (Grant,1987; Davis, pers. comm.; Tebbutt pers. comm.).

Possibility (1) is supported by the opening of the Bribie Island bridge in October 1963. Pollock & Williams (1983) reported improvements in angling techniques and equipment with fishing trips corresponding to favourable tides and the standardisation of light angling gear and bait. This supports (2). (3) is supported by Hyland & Butler (1989) and Hyland et al. (1989) who show natural and human modification to habitats around Bribie Island over the study period. There is no evidence to prove or disprove (4). (5) is unlikely because a creel survey in November 1980 at Bribie Island by Morton (1982) indicated that *S. ciliata* made up 97% of the catch and for the same year the YMW at Bribie Island was one of the lowest for 33 years at 0.135kg/fish. It is hypothesised that this decline is an actual decline in the mean weight of legally sized *S. ciliata* caused by a combination of 1-5.

TABLE 5. Catch data of the net fishery from Caloundra to Southport.

Year	Days fished	CPUE (kg/day)	Whiting catch (kg)
1988	6591	20	133266
1989	6418	19	127980
1990	6219	19	121669
1991	6887	16	112354

YMW at Jumpinpin from 1971–1991 showed no statistical change. However, graph of YMW at Jumpinpin (Fig.2) suggests a decline over that period. As data are available for only 13 of the 21 years this is inconclusive.

Average YMW at Inskip Point is lower than at other locations. It is hypothesised that this is due to a higher proportion of *S. analis* in the catch (Grant,1982). The YMW at Inskip Point, Moreton Island and Southport have remained stable over the study period with variations caused by yearly fluctuations such as weather and tides at the time of club competitions.

YMC of Summer Whiting

Morton's (1982) creel survey in 1980 of everyday anglers on Bribie Island found that the average catch per angler was 13 fish in November of that year. We calculate YMC at Bribie Island during 1980 as 25 per angler. Therefore YMC's in this study are larger than the actual CPUE's at each location due to: 1, calculation of YMC from recreational fishing club anglers included only those who caught one or more summer whiting, those who caught none were excluded from the calculation; 2, club anglers possibly having higher CPUE's than non club anglers due to experience.

CPUE is commonly used as an indicator of stock abundance by fisheries biologists (Gulland,1964; Bannerot & Austin,1983). Any changes in YMC may therefore indicate changes in summer whiting abundance. In the present study YMC has increased from 1959 to the early seventies at 4 of the 5 study locations (Bribie Island, Moreton Island, Jumpinpin and Southport). It is possible the rise in YMC is due to an increase in stock size but this is unlikely as the YMC has not be standardised for improvements in angling techniques and equipment. No data are available for YMC at Inskip Point until 1980.

YMC increased at Bribie and Moreton Islands, Jumpinpin and Southport from 1959 to the early seventies due to an improvement in angling techniques and equipment, such as the introduction of hollow fibreglass rods and the availability of lighter gear.

The YMC at Bribie Island declined from 1975–1991 due to: 1, a decline in the total number of summer whiting or 2, a decline in the number of legally sized summer whiting with a corresponding increase in the number of undersized summer whiting.

There is no evidence of a decline in YMC at any of the other study locations from the early seventies. As there have been no significant advances in angling techniques and equipment during this time, which would require standardisation of the data, it is likely that the stock levels of summer whiting have remained stable at these locations over the 20 year period. Because Inskip Point and Bribie Island are considered to be summer whiting fisheries their YMCs should be higher than others. YMC is highest at Inskip Point. The YMC's at Bribie Island, Moreton Island and Southport are similar but lower than the YMC at Inskip Point. The YMC at Jumpinpin is much lower than at any of the other four locations (Table 4).

The YMC at Bribie Island is the same as at Moreton Island and Southport because: 1, the population of legally sized summer whiting at Bribie Island has declined; or 2, the length of the club competitions were longer at Moreton Island and Southport (12–15hrs) than at Bribie Island (8–10hrs).

Commercial Catch of Whiting

Reliability of commercial catch data prior to 1981 has been validly questioned (Gray & Spencer,1986) but they remain the only available information and are indicative of the level of catch. Catches for the commercial net and trawl fisheries cannot be separated prior to 1981 so it is not certain why a significant increase occurred up to 1973, although the most likely reasons are the expansion of the commercial fisheries in terms of number of commercial fishers and the areas fished and advances in the types of gear used.

After 1988 they are separated into net and trawl catches. The whiting catch of the net fishery is considered to consist of summer whiting as this is the most common whiting caught by recreational fishers who fish the same areas as the commercial fishers. A significant decrease of the total whiting catch in the net fishery of c.6% per year has occurred from 1988–1991. This decline can be explained to a degree by a decline in the total number of days on which net fishers caught whiting (Table 5). However this does not explain the drop in total catch in 1991 when almost 6,900 days of fishing were reported, the greatest number of days fished in the four year period.

As the CPUE of whiting has remained fairly constant from 1988–1991 (Table 5) those whiting stocks utilised by net fishers in the Moreton Bay region are probably stable.

ACKNOWLEDGEMENTS

Thanks must be extended to the Amateur Fishing Clubs who made their club records available and to all the reviewers who offered constructive criticism on this paper. The paper however remains the sole responsibility of the authors. A

special thanks must also be extended to Graeme Duckworth for creation of the recreational fisheries database and Ken Davis and Fred Tebbutt who estimated the mean weights and lengths of the two species of summer whiting.

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CATALOGUE OF METEORITES, TEKTITES AND ASSOCIATED MATERIAL IN THE QUEENSLAND MUSEUM

PETER VOLK

Volk, P. 1994 06 01: Catalogue of meteorites, tektites and asssociated material in the Queensland Museum. *Memoirs of the Queensland Museum* 35(1): 255-262. *Brisbane. ISSN 0079-8835.*

Catalogue of meteorite and related material held by the Queensland Museum lists 144 meteorites, 162 tektites and tektite bulk samples, 10 casts and 10 specimens of related material. □ *Meteorites, tektites, catalogue, Tenham, Glenormiston, Thunda, Gladstone #2, Queensland Museum.*

Peter Volk, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; 2 November 1993.

Geology collections of the Queensland Museum (QM) were initiated in 1871 (Mather, 1986). However, the first meteorite accessioned was a slice of the Gibeon meteorite (D864) in 1916, and the first Queensland (Qld) meteorite the Glenormiston (D1291) in 1926. Major contributions of meteoritic material were made by the Geological Survey of Queensland (G.S.Q.) in 1979 and Mr. F.S. (Stan) Colliver in 1985.

Collection auditing by the author in 1993 has revealed a total holding of 144 meteorites, 162 tektites or bulk tektite fragment samples, 12 casts and 10 specimens of related material.

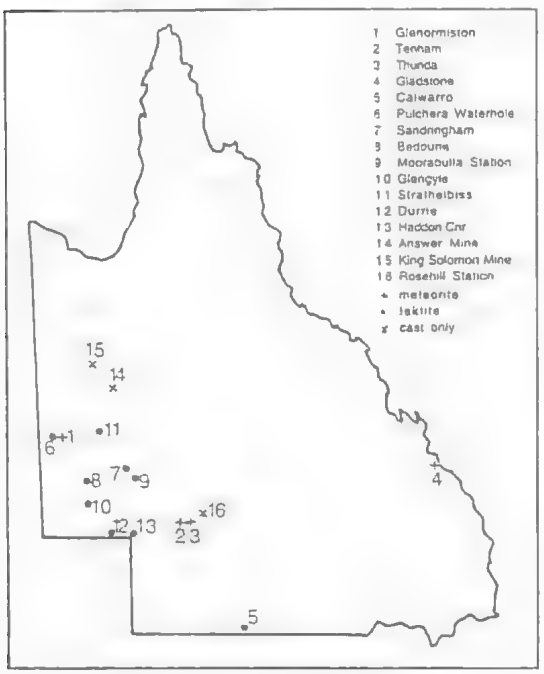

FIG. 1 Provenance of Queensland meteoric material held by the Queensland Museum.

QUEENSLAND MATERIAL
(Fig. 1)
METEORITES

D1291
Glenormiston Meteorite

TYPE
Medium octahedrite.

MATERIAL
FIND: Glenormiston, nr Boulia, Qld (22°54'S,138°43'E): main mass, 38.8kgs; four small pieces cut from main mass, 2.5g, 1.3g, 0.9g, 0.6g; shavings, heavily oxidised, 18.9g.

REFERENCE
Richards, (1930: 65-72, pls 3-8).

REMARKS
Purchased in 1926 from Mr. F. H. Story; sectioned for analysis; present location of the smaller part thus produced unknown.

D1592 , D4465
Tenham Meteorites

TYPE
Brecciated, olivine - hypersthene chondrite.

MATERIAL
FALL: Tenham Station, nr Ingella, Queensland (25°44'S 142°57'E), 1879. [Prior (1953) recorded "Spring" but QM records suggest that the fall took place earlier in 1879. Prior may have been referring to the boreal spring].

Weights of individual stones are given below; sectioned stones (S) are noted and the weight is the remaining piece. Missing stones (M) are indicated. Numbers refer to those given by Hodge-Smith (1939, pls. 10, 11). Letters refer to a set of ten stones, registered as D4465, donated to the Queensland Museum by the Geological Survey of Queensland in 1979 which are probably part of the set of fourteen stones loaned to the Geological Survey by Miss O. A. Hammond in 1940 and recorded as unlocatable (Brooks, Simmonds & Houston,1964).

1:2115.6; 2:1931.7; 3:639.5, S; 4;1768.8; 5:1671.0; 6:1272.8; 7:1258.6; 8:996.3; 9: M; 10: M; 11: 865.7; 12: 861.0; 13:831.2; 14;807.9; 15:762.2; 16:752.7; 17:724.8; 18:660.4; 19:612.2; 20:606.4; 21:612.0; 22: 582.3; 23:572.1; 24:603.1; 25:482.2; 26:473.7; 27:608.8; 28:316.8, S; 29:576.4; 30:491.6; 31:449.6; 32:433.9; 33:444.6; 34:407.8; 35:404.9; 36:399.1; 37:390.2; 38;375.0; 39:304.0; 40: M; 41: M; 42:353.7; 43:379.8; 44:354.2; 45:348.1; 46:352.0; 47:353.2; 48: M; 49;338.6; 50:306.9; 51;281.8; 52:262.1; 53:264.9; 54:256.7; 55:273.2; 56:276.8; 57:54.4, S; 58:243.9; 59:262.3; 60:252.6; 61;242.0; 62:235.3; 63;205.0; 64:219.4; 65:212.3; 66;217.4; 68:195.9; 69:217.3; 70:200.2; 71:200.4; 72:189.6; 73:184.2; 74:191.5; 75:196; 76:199.7; 77:198.8; 78:192.3; 79:180.4; 80:180.5; 81:184.7; 82:172.6; 83:162.0; 84:167.5; 85:159.4; 86:157.3; 87:157.8; 88:143.0; 89:163.6; 90:145.8; 91:149.8; 92:134.2; 93:132.5; 94:141.1; 95:121.6; 96:125.3; 97:122.9; 98:101.8; 99: M; 100:81.1; 101:84.4; 102:79.0; 103:88.0; 104:81.8; 105:79.8; 106:80.7; 107:87.5; 108:70.2; 109:69.2; 110:69.7; 111:74.1; 112:59.8; 113:54.8; 114:55.4; 115;59.7; 116;56.5; 117:54.9; 118:37.8; 119:48.6; 120:43.8; 121:37.2; 122:44.8; 123:24.3; 124:30.3; 125:21.9; 126:22.6; 127:14.5.

"Hammond" Stones – 'b':476.7; 'c':416.4; 'D':252.2; 'g':169.5; 'h':129.4; 'i':104.8; 'j':89.2; 'L':81.1; 'm':55.5; 'N':56.9.

REFERENCES

Brooks, Simmonds and Houston (1964); Hodge-Smith (1939) p. 25, pls X, XI; Spencer (1937).

REMARKS

Of 127 specimens illustrated by Hodge-Smith (1939, pls 10, 11), 121 are in the QM collection. Stones 9, 10, 40, 41, 48 and 99 are missing; stones 57, 28 and 3 have each been sectioned and half of each is missing; stone 57 was sectioned by Lovering, one piece retained by him; stone 28 was sectioned and one piece sent to H.H. Nininger; no record exists of the fate of half of stone 3. Of the six missing stones, 10 and 99 were transferred to the Geological Survey of Queensland; stones 40 and 41 were sent to either the University of Queensland or the G.S.Q. but records confuse each stone's destination; stones 48 and 9 are unaccounted for. One stone was sent to the American Museum of Natural History in exchange for a fragment of the Selma meteorite.

Other holdings of Tenham stones are in the British Museum, University of Queensland, and the Australian Museum. Total Tenham Stones in the QM collections: 131.

D1606
Gladstone Meteorite #1

TYPE

Coarsest octahedrite.

MATERIAL

FIND: Toondon Ck, 4 miles south of Gladstone, (23°54'S, 151°15'30"E), in 1912 or 1913: 42.4g slice, heavily varnished.

REFERENCES

Richards (1930: 66-67);Hodge-Smith (1939: 18); Prior (1953: 134); Simmonds (1964: 3, pl. 3, fig.1).

REMARKS

The main mass is in the Field Museum of Natural History, Chicago. An analysis appears in Richards (1930) and a description and a picture of this slice in Simmonds (1964). Other holdings are Australian Museum, Sydney, American Museum of Natural History Museum, New York, United States National Museum, Washington (Prior,1953).

D5834
Thunda Meteorite

TYPE

Medium octahedrite.

MATERIAL

FIND: Thunda, Windorah, Qld (25°42'S, 143°3'E), pre 1881: 43.2g slice.

REFERENCES

Dunstan (1913: 178); Liversidge (1886: 73); Hodge-Smith (1939: 25); Prior (1953: 371).

REMARKS

Donated to the Queensland Museum by T.

Davis of London in 1981. Other holdings see Hodge-Smith (1939) and Prior (1953).

D13519
Gladstone Meteorite #2

TYPE
Coarsest octahedrite.

MATERIAL
FIND: 4.5 miles S. of Gladstone, QLD (23°54'30"S, 151°15'30"E): 1 piece, 17.6kg with cut and polished face; 1 box shavings, approx. 4.7kg.

REFERENCE
Simmonds (1964: 3-5 pls 1-3).

REMARKS
Simmonds (1964) suggested that Gladstone #1 and #2 were part of a multiple fall. The specimens were acquired from the G.S.Q.

QUEENSLAND TEKTITES (AUSTRALITES)

D2078
Australite

MATERIAL
Paroo River, Caiwarro, nr Eulo, Qld (28°42'S, 144°47'E): 2.5g, lens shape.

REMARKS
Donated by Mrs E.A. Morley, 14.3.1956. Found in gravel bed of river.

D3697, D3698, D3699, D3700
Australites

MATERIAL
Pulchera Waterhole, Mulligan River, Qld (23°56'S, 138°38'E): 5.7g, 0.5g (fragment), 6.6g, 1.8g respectively.

REMARKS
Donated by Mr R. Suter 28.10.1971.

D3701, D3702
Australites

MATERIAL
12 Mile Waterhole, Sandringham, Qld (approx. 29°03'S, 139°04'E): 1.8g, 4.3g respectively.

REMARKS
Donated by Mr R. Suter, 29.10.1971.

D3703
Australite

MATERIAL
Sandhills, Bedowrie, Qld (25°00'S, 149°03'E): 4.6g.

REMARKS
Donated by Mr R. Suter, 29.10.1991.

D3704
Australite

MATERIAL
Moorabulla Waterhole, Sandringham, Qld (24°16'S, 140°51'E): 7.9g.

REMARKS
Donated by Mr R. Suter, 29.10.1971.

D3705
Australite

MATERIAL
Georgina River, Glengyle, Qld (24°47'S, 139° 35'E): 5.8g.

REMARKS
Donated by Mr R. Suter, 29.10.1971.

D3706
Australite

MATERIAL
Duck Ck Claypan, Bedowrie, Qld (approx. 25°00'S, 149°3'E): 13.3g.

REMARKS
Donated by Mr R. Suter, 29.10.1971.

D3707
Australite

MATERIAL
Sandhill, Strathelbiss, Qld (22°48'S, 140°01'E): 10.4g.

REMARKS
Donated by Mr R. Suter, 29.10.1971.

D3708 , D3709 , D3710, D3711, D3712, D3713, D3714, D3715, D3716, D3717, D3718, D3719
Australites

MATERIAL
Durrie Stn, between dune ridges SW Qld (25°57'S, 140°13'E): D3708, 14 round buttons, part flanged: 2.1, 2.8, 1.1, 2.4, 4.1, 2.2, 2.4, 3.5, 2.7, 1.5, 1.7, 1.7, 1.6, 0.6g; D3709, 24 round lenses: 1.1, 1.0, 1.1, 1.0, 1.5, 2.3, 1.9, 1.4, 3.5, 1.5, 1.3, 1.7, 1.9, 1.8, 2.8, 3.2, 3.3, 1.1, 0.9, 1.1, 1.1, 1.0, 1.2, 1.2g; D3710, 12 elongate forms, part flanged: 3.7, 3.0, 3.0, 2.2, 1.7, 1.8, 2.4, 2.3, 1.2, 0.8, 1.3, 1.5g; D3711, 27 cores: 2.8, 6.0, 2.2, 7.6, 7.3, 3.8, 3.5, 2.8, 2.2, 1.9, 5.3, 7.4, 9.1, 8.7, 5.3, 4.6, 3.1, 3.5, 3.9, 5.3, 2.3, 3.0, 2.8, 5.8, 4.6g (1 specimen missing); D3712, 12 flanged fragments: 1.4, 0.7, 0.9, 1.0, 0.8, 0.5, 0.8, 1.6, 1.2, 1.5, 0.5, 0.4g; D3713, 4 elongate tears: 3.5, 3.7, 4.8, 2.0g;D3714, 5 broken cores: 1.8, 3.2, 2.7, 1.9, 1.8g;D3715, 1 blown out lens: 2.1g;D3716, 7 micro forms, part flanged: 0.3, 0.7, 0.6, 0.4, 0.4, 0.3, 0.9g; D3717, 10 forms spalling: 2.2, 1.3, 5.2, 3.3, 2.5, 2.3, 1.9, 4.7, 3.3, 3.1g; D3718, 7 elongate forms: 10.1, 6.2, 10.2, 3.2, 10.7, 1.7, 6.7g;D3719, 12 nondescript forms: 2.3, 0.9, 1.1, 1.2, 1.9, 0.5, 0.6, 0.3, 1.0, 1.9, 1.2, 1.2g.

REMARKS
Donated by Mr G. Hume, 29.10.1971.

D3720
Australites

MATERIAL
Haddon Cnr, SW Qld (26°02'S, 141°01'E): bulk sample - over 317.1g. [A small amount of this material is on loan and was not available for weighing].

REMARKS
Aboriginal artefacts and flakes chipped from Australites from Aboriginal site. Donated by G. Hume, 29.10.1971.

QUEENSLAND MATERIAL
CASTS

D3729
"Answer" meteorite

MATERIAL
ORIGINAL FIND: Old Camp, nr Answer Mine, S of Selwyn, Qld, Mr. J. Finch, 16 .6.1970.

REFERENCE
Houston (1971:484, pls 2,3.).

REMARKS
This cast is in poor condition, damaged and chipped. Houston (1971) stated that the original meteorite was returned to the owner after analysis.

D3730
"King Solomon" meteorite

MATERIAL
ORIGINAL FIND: 100 yards from King Solomon Mine, N of Mary Kathleen, NW Qld.

REFERENCE
Houston (1971:482, pl. 1.).

REMARKS
This specimen is slightly chipped and showing shrinkage cracks. Houston (1971) stated that the original meteorite was returned to the owner after analysis.

D13520 , D13549
Gladstone meteorite #2

REMARKS

These casts were taken before sectioning of the original. D13520 is massively damaged on one face; D13549 is in reasonable condition, having only minor damage. D13520 was donated by the G.S.Q. No record of donor of D13549 exists, though it almost certainly from the same source.

D13053
"Siderite"

MATERIAL
ORIGINAL FIND: Rosehill Station, about 1½ mls E of Retreat Hmstd, 3 mls S of Barcoo River, nr Cheviott Range, SW Qld: 2 casts, in good condition.

REMARKS
Original meteorite is recorded as being in the possession of Mr Jack Arden of "Akary" on Neave River, Charleville. There appear to be no references to this specimen. Considering the proximity of this site to Thunda, it is possible that the Thunda fall was multiple and that this meteorite was part of that fall.

NON- QUEENSLAND MATERIAL METEORITES

D864
Gibeon Meteorite

TYPE
Fine octahedrite.

MATERIAL
Find: Amalia Farm, nr Gibeon, SW Africa (25.5°S, 18°E): 1 slice, 818g (10x19x0.5cm).

REFERENCE
Prior (1953:131,132).

REMARKS
Shows Widmanstatten figures, troilite nodules and flow structure.

D2185
Aerolite

TYPE
Chondrite.

MATERIAL
FIND: Dimmitt, Texas, U.S.A. (34° 10'N, 102°10'W): 3 slices, 33.5g, 20.7g, 11.1g.

REFERENCE
Prior (1953:104).

REMARKS
Acquired by exchange with H.H. Ninninger, American Meteorite Museum, 23.7.1959.

D2186, D2296
Toluca Meteorite

TYPE
Medium octahedrite.

MATERIAL
FIND: Xiquipilco, Mexico (19°34'N, 99°34'W): D2186, 37g; D2296, 385g.

REFERENCE
Prior (1953:374).

REMARKS
Shows schriebersite inclusion and Widmanstatten figures. Sectioned in three directions. D2186 acquired by exchange with H.H. Ninninger, American Meteorite Museum,23.7.1959.

D2272
Selma Meteorite

TYPE
Olivine - bronzite spherical chondrite.

MATERIAL
FIND: Dallas County, Alabama, U.S.A. (32°24'N, 87°0'W):852.7g.

REFERENCE
Prior (1953:340,341).

REMARKS
Slab section, showing cracking and fracturing, with edges starting to break off main mass. It is recorded that this specimen was obtained from the American Museum of Natural History (AMNH3856) in exchange for one of the Tenham meteorites.

D8550
Meteoric Iron

MATERIAL
Unrecorded: two pieces, 18.7g, 1.6g.

D13040
Henbury Meteorite

TYPE
Medium octahedrite.

MATERIAL
FIND: About 100 mls S of Alice Springs on Henbury Station.(24°34'S, 133°10'E): two pieces, 11.0, 5.5g.

REFERENCE
Prior (1953:151,152).

REMARKS
Donated by Mr R.B. Brown.

D1522
Henbury Meteorite #7

TYPE
Medium octahedrite.

MATERIAL
FIND: Henbury, Finke River, Central Australia. (24°34'S, 133°10'E): 43.5kg.

REFERENCE
Prior (1953:151,152).

REMARKS
Donated by R. Bedford, Kyancutta.

D1527
Meteorite "Schrapnel"

MATERIAL
Henbury, Central Australia (24°34'S, 133°10'E).

REFERENCE
Prior (1953:151-152).

REMARKS
Seven fragments torn from crater meteorite.

D17060
Metallic Meteorite

MATERIAL
Unknown location: 339.1g.

REMARKS
The specimen shows similar characteristics to other pieces of the Henbury meteorite in our collection and may be from that location. This piece was donated by Mr. F. S. Colliver.

TEKTITES AND AUSTRALITES

D1649
Australites

MATERIAL
Nullabor Plain, W.A.: six specimens.

REMARKS
Collected(?) by Mr A.E. Baker.

D2187
Tektite

MATERIAL
South Vietnam: 13.2g.

REMARKS
Obtained by exchange with H.H. Ninninger, American Meteorite Museum.

D3690
Australite

MATERIAL
Myrtle Springs, nr Maree, South Australia: 15.3g.

REMARKS
Donated by D.F. Roder.

D13041
Australite

MATERIAL
60 miles S.W. of Finke Siding, N.T.: 12.9g.

D13518
Australites

MATERIAL
Boulder, W.A.: five specimens, 6.5, 5.5, 6.1, 5.7, 3.0g.

REMARKS
Three lenses, two elongate.

CASTS

D20
Cowra Siderite

MATERIAL
ORIGINAL FIND: Junction of Burrowa and Lachlan Rivers, Cowra District (Hodge-Smith, 1939).

REMARKS
Obtained through exchange with the Australian Museum, Sydney. Specimen in good condition.

D21
Bingera Siderite (Bingera No. 1)

MATERIAL
ORIGINAL FIND: Bingera, N.S.W.

REMARKS
Obtained through exchange with the Australian Museum, Sydney. Specimen in good condition.

D22
Barraba Siderite (Bingera No. 3)

MATERIAL
FIND: Between Barraba and Bingera, N.S.W.

REMARKS
Obtained through exchange with the Australian Museum, Sydney. The Barraba meteorite is a known synonym of Bingera No. 3 (Hodge-Smith, 1939).

D24
Mt Browne Aerolite

MATERIAL
FALL: 9.30 a.m. 17.07.1902; Mt. Browne, Co. Evelyn, N.S.W.

REMARKS
Obtained through exchange with the Australian Museum, Sydney. Showing significant paint loss on one face; otherwise in good condition.

D133
Roebourne Meteorite

MATERIAL
FIND: Alluvial plains 200 miles S.E. of Roebourne, W.A.

REMARKS
Donated by the West Australian Museum.

D433
Barratta Aerolite (Barrata No. 1)

MATERIAL
FIND: Barratta Station, via Denilquin, N.S.W.

REMARKS
Obtained through exchange with the Australian Museum, Sydney.

D434
Narraburra Siderite

MATERIAL
FIND: Narraburra Ck (= Yeo Yeo Ck) nr Temora, N.S.W.

REMARKS
Obtained through exchange with the Australian Museum, Sydney.

RELATED MATERIAL

D1524

MATERIAL
Outside of west rim of main crater, Henbury, Central Australia. (24°34'S, 133°10'E): five bombs of melted country rock.

REFERENCE
Prior (1953: 151, 152).

REMARKS
Obtained through exchange with the Kyancutta Museum, South Australia.

D1525

MATERIAL
1/2 mile E of Main Crater, Henbury, Central Australia (24°34'S, 133°10'E): silica glass, impregnated with *Fe* and *Ni*.

REFERENCE
Prior (1953: 151, 152).

REMARKS
In drops and coating pebbles. Obtained through exchange with the Kyancutta Museum, South Australia.

D1526

MATERIAL
Henbury, Central Australia. (24°34'S, 133°10'E): six shale balls and associated fragments.

REFERENCE
Prior (1953: 151, 152).

REMARKS
Produced by subsurface weathering of iron fragments.

D2167, D2168, D2181

MATERIAL
Arizona Meteorite Crater, U.S.A. (35°3'N, 111°2'W): meteorite condensation spheroids.

REFERENCE
Prior (1953: 62, 63).

REMARKS
Obtained through exchange with H.H. Nininger. D2167 and D2181 are each one small bottle of the spheroids. D1268 has some spheroids displayed on a microscope slide against a white background.

D2182, D2183, D2184
Impactite

MATERIAL
Arizona Meteorite Crater, U.S.A. (35°3'N, 111°2'W): three specimens.

REFERENCE
Prior (1953: 62, 63).

REMARKS
Formed from dolomitic, arenaceous, Kaibab limestone.

D13042

MATERIAL
Wabar (or Wabur) Meteor Crater, Rub 'al Khali, Saudi Arabia (21°29'N, 50°40'E): black and white glass, 1.9g.

REFERENCE
Prior (1953: 396).

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NINE NEW SPECIES OF GEOSCAPHEINAE (BLATTODEA: BLABERIDAE) FROM AUSTRALIA

J.A. WALKER, D. RUGG AND H.A. ROSE

Walker, J.A., Rugg, D. & Rose, H.A. 1994 06 01: Nine new species of Geoscapheinae (Blattodea: Blaberidae) from Australia. *Memoirs of the Queensland* 35(1): 263-284. Brisbane. ISSN 0079-8835.

Nine new species of soil burrowing Geoscapheinae cockroaches are described from Queensland: *Geoscapheus rugulosus, G. woodwardi, Macropanesthia heppleorum, M.kinkuna, M.lithgowae, M. rothi, M. saxicola, Neogeoscapheus barbarae*, and *Parapanesthia pearsoni*. Keys to the genera and species of Geoscapheinae are provided. The male of *M. monteithi* Roth and the male genitalia of *M. kraussiana* (Saussure) are described.

☐ *Blattodea, Geoscapheinae, new species, taxonomy, keys, Australia.*

J.A. Walker & H.A. Rose, Department of Crop Sciences, University of Sydney, New South Wales 2006, Australia; D. Rugg, Merck Sharp and Dohme Veterinary Research and Development Laboratories, PO Box 135, Ingleburn, New South Wales 2565, Australia; 15 November 1993.

The Geoscapheinae contains soil burrowing species which feed on dry leaf litter. Biology of a representative, *Macropanesthia rhinoceros* Saussure, was described by Rugg & Rose (1991). *Geoscapheus* Tepper, *Macropanesthia* Saussure, *Neogeoscapheus* Roth and *Parapanesthia* Roth are endemic to Australia. Roth (1977) placed the 4 genera in the Panesthiinae. Rugg & Rose (1984) reinstated the Geoscapheinae with these 4 genera on differences in reproductive biology, morphology and ecology.

We describe 9 new species of Geoscapheinae from various areas of Queensland (Fig.1). Roth (1977) described *M. monteithi* Roth from female specimens only and *M. kraussiana* (Saussure) from a damaged male lacking genitalia. He described all other Geoscapheinae and Australian Panesthiinae from males. McKittrick (1964) showed that male genitalia are important specific features in cockroaches so we describe the male of *M. monteithi* and the male genitalia of *M.kraussiana*.

Measurements are in millimetres unless stated. Scale bars represent 2mm unless stated. In descriptions of males, measurements of the holotype are given and those of the paratypes are in brackets. Measurements of females refer to the paratypes. Terminology used for the male genital phallomeres is that of McKittrick (1964) and Roth (1977). Keys are for adults only but can often be applied to nymphs.

ABBREVIATIONS USED

COLLECTORS: BRR, B.R. Rose; HAR, H.A. Rose; DR, D. Rugg; JAW, J.A. Walker; JRW, J.R. Woodward.

MUSEUMS: ANIC, Australian National Insect Collection, CSIRO, Canberra; MMUS, Macleay Museum, The University of Sydney, Sydney; QM, Queensland Museum, Brisbane; UQIC, University of Queensland Insect Collection, Brisbane; SAM, South Australian Museum, Adelaide; USIC, The University of Sydney Insect Collection (Department of Crop Sciences), Sydney.

SYSTEMATICS

Family BLABERIDAE
Subfamily PANESTHIINAE

Wings and tegmina present (though may be vestigial or reduced through mutilation); if wings and tegmina totally absent then laterocaudal angle of tergite 6 is not produced into a spine.

Subfamily GEOSCAPHEINAE

Wings and tegmina totally absent and laterocaudal angle of tergite 7 produced and directed laterally or dorsally; if directed ventrocaudally or obliquely posteriorly then laterocaudal angle of tergite 6 produced into a short spine.

KEY TO GENERA OF GEOSCAPHEINAE

1. Posterior margin of tergite 6 without spines or tubercles (exclusive of the laterocaudal angle), but may be thickened and weakly undulate, or with a raised ridge 2
   Posterior margin of tergite 6 with one or

more raised spines or tubercles, exclusive of the laterocaudal angle 3

2. Laterocaudal angle of tergites 6 and 7 produced into large spines, that on 6 curved dorsad, that on 7 directed obliquely upwards .. .. *Geoscapheus*

Laterocaudal angle of 6 not produced or if produced then not curved dorsad, that on 7 directed slightly or strongly dorsad, or ventrocaudally or obliquely and posteriorly ... . *Macropanesthia*

3. Posterior margin of tergite 6 with a single large, upturned acute spine, or a broadly rounded tubercle lateral to a small or non-produced caudal angle ..... *Neogeoscapheus*

Posterior margin of tergite 6 with several erect rounded tubercles laterally .... *Paraponesthia*

KEY TO SPECIES OF *GEOSCAPHEUS*

1. Hind margin of supraanal plate crenulate .... *G. crenulatus* (Shaw)

Hind margin of supraanal plate smooth 2

2. Thoracic nota cream to castaneous laterally, pronotum black anteromedially .... *G. woodwardi* sp. nov.

Thoracic nota black or ferrugineous 3

3. Dorsal surface matt; anterior pronotal margin with a single tubercle (♂) .... *G. rugulosus* sp. nov.

Dorsal surface shiny; anterior pronotal margin without, or with two, tubercles (♂) 4

4. Abdominal tergites sparsely punctate, mostly laterally; lateral angles of supraanal plate rounded, shallow, but usually distinct; hind margin of last sternite deeply concave (♂) ... . *G. robustus* (Tepper)

Abdominal tergites usually densely punctate, lateral punctations larger; lateral angles of supraanal plate hardly produced; hind margin of last sternite shallowly concave (♂) .... *G. dilatatus* (Saussure)

KEY TO SPECIES OF *NEOGEOSCAPHEUS*

1. Hind margin of tergite 6 with a large spine separate from the laterocaudal angle 2

Hind margin of tergite 6 with a rounded tubercle separate from the laterocaudal angle . ..... *N. hirsutus* (Shaw)

2. Laterocaudal angle of tergite 6 produced into a small spine, directed posteriorly; tergites finely punctate medially ..... *N. dahmsi* Roth

Laterocaudal angle of tergite 6 not produced into a spine; tergites smooth to sparsely and weakly punctate medially .... *N. barbarae* sp. nov.

KEY TO SPECIES OF *PARAPANESTHIA*

Laterocaudal angle of tergite 6 produced into a small spine; posterior margin of tergite 5 without tubercles ..... *P. pearsoni* sp. nov.

Laterocaudal angle of tergite 6 not produced into a spine; posterior margin of tergite 5 often with several tubercles laterally .... *P. gigantea* (Tepper)

KEY TO SPECIES OF *MACROPANESTHIA*

1. Thoracic nota with a cream to orange border laterally ..... *M. kraussiana* (Saussure)

Thoracic nota ferrugineous, brown or black, laterally 2

2. Cerci bulbous, apex broadly rounded, densely setose dorsally and ventrally 3

Cerci tapered, apex acutely rounded, dorsal surface not setose and with a medial ridge ... 5

3. Laterocaudal angle of tergite 6 produced into a small spine; spine on laterocaudal angle of tergite 7 directed ventrocaudally .... *M. rothi* sp. nov.

Laterocaudal angle of tergite 6 not produced; spine on laterocaudal angle of tergite 7 directed dorsally 4

4. Pronotal length less than 15mm; total length less than 55mm; males with weakly developed disc tubercles on pronotum .... *M. heppleorum* sp. nov.

Pronotal length greater than 15mm; total length usually greater than 60mm; males with clearly developed pronotal disc tubercles ..... *M. rhinoceros* Saussure

5. Anterolateral corners of tergites 6 and 7, and often tergite 5, with round holes 6

Anterolateral corners of tergites without holes 7

6. Posterior margin of supraanal plate smooth, lateral corners (posterior to cerci) rounded ... . *M. mackerassae* Roth

Posterior margin of supraanal plate crenulate, lateral corners (posterior to cerci) produced into acute spines ..... *M. kinkuna* sp. nov.

7. Laterocaudal angle of tergite 6 produced into a very small spine; laterocaudal angle of tergite 7 with a spine directed ventrocaudally; males with weak premarginal disc tubercles .. .. *M. saxicola* sp. nov.

Laterocaudal angle of tergite 6 not produced;

laterocaudal angle of tergite 7 directed laterally or dorsally; males with strongly recurved premarginal disc tubercles 8

8. Posterior margin of tergite 6 with a broadly rounded peak 3-5mm from lateral margin; margin of supraanal plate smooth .... *M. lithgowae* sp. nov.

Tergite 6 with lateral two thirds of posterior margin thickened evenly; margin of supraanal plate smooth or weakly crenulate ... . *M. monteithi* Roth

Geoscapheus rugulosus sp. nov. (Fig. 2)

MATERIAL EXAMINED

HOLOTYPE: ♂, Blackdown Tableland, Expedition Range, 23°48.5'S 149°03.5'E, dug up, 16.xii.1986, HAR, DR, L. Sanchez, JRW, QM.

PARATYPES: 2 ♂, same data as holotype, QM; 1 ♀, Blackdown Tableland, Blackdown Base, 23°33'S 149°39'E, dug up, 5.iv.1988, HAR, QM; 1 ♂, 1 ♀, Blackdown Tableland, Expedition Range, 23°49'S 149°04'E, dug up, 25.vi.1992, BRR, HAR, JAW, JRW, ANIC.

OTHER MATERIAL: 5 ♂, 3 ♀, 3 ♂ nymphs, 2 ♀ nymphs, Blackdown Tableland, Expedition Range, 23°48.5'S 149°03.5'E, dug up, 16.xii.1986, HAR, DR, L. Sanchez, JRW, USIC; 5 ♂, 1 ♀, Blackdown Tableland, Blackdown Base, 23°33'S 149°39'E, dug up, 5.iv.1988, HAR, USIC; 3 ♀, 7 ♂ nymphs, 6 ♀ nymphs, Blackdown Tableland, Expedition Range, 23°49'S 149°04'E, dug up, 25.vi.1992, BRR, HAR, JAW, JRW, USIC.

DESCRIPTION

Male

Colour. Head ferrugineous, basal half of clypeus labrum genae and mandibles black; pronotum ferrugineous laterally, darker to black medially and anteriorly; meso- and metanotum ferrugineous laterally, dark brown to black medially; legs ferrugineous, tibia and spines black; abdominal tergites very dark brown to black; supraanal plate black; S2–6 black laterally, ferrugineous medially; S7 dark brown to black laterally and posteriorly, ferrugineous anteromedially; subgenital plate dark brown; cerci dark brown; dorsal surface matt; ventral surfaces shiny.

Measurements. Total length 52.7 (51.0–55.8), pronotal length x width 16.3 x 27.7 (15.2–17.5 x 26.0–28.9).

Head. Densely punctate, hidden under pronotum, frons sculptured with irregular fine grooves.

Thorax. Pronotum convex, subsemicircular, with a medial premarginal thickening forming a broad transverse tubercle (Fig.2D); disc depressed posterior to tubercle to 2–3mm from posterior margin which is thickened medially, floor of depression roughened and granular behind anterior tubercle and anterior to a pair of oblique anterior grooves, posterior portion of depression relatively smooth; pronotum strongly and densely punctate; meso-and metanotum punctate and finely grooved, punctations larger and denser laterally; anteroventral margin of front femur with 2 or 3 large spines basally and a small distal spine, posterior margin with a large distal spine.

Abdomen. T1–6 punctate and with fine irregular grooving, punctations larger and denser laterally, grooved sculpturing more pronounced medially; laterocaudal angle of T6 produced into a large dorsally reflexed spine (Fig. 2C); T7 strongly and densely punctate, lateral margins concave, laterocaudal angle produced into a short slightly upturned oblique spine; supraanal plate strongly and densely punctate, laterocaudal angle slightly produced obtusely, posterior margin slightly upturned and weakly undulate; sternites punctate, punctations stronger and denser laterally; S7 broadly rounded, concavely truncated posteriorly exposing subgenital plate; subgenital plate punctate; cerci bulbous, tapering to an obtusely rounded tip, proximal half with a dorsal medial ridge, densely setaceous ventrally except on anterior margin, dorsal surface nonsetose anteriorly, setaceous on posterior margin and sparsely setaceous posterior to medial ridge; genitalia developed but variable, L2d absent, L2vm present, L1 present but often weakly sclerotised, R2 varies from a short weakly sclerotised mound to a strong hook (Fig. 2B,E).

Female

Differs from male as follows: pronotum without premarginal thickening, disc hardly if at all depressed, posterior margin hardly thickened; body more dorsoventrally compressed; S7 not truncated posteriorly; subgenital plate absent.

Measurements. Total length 50.4–51.9, pronotal length x width 13.8–15.0 x 24.9–27.5.

Nymph

Similar to adult but without adult pronotal characters. Usually lighter in colour than adults particularly ventrally.

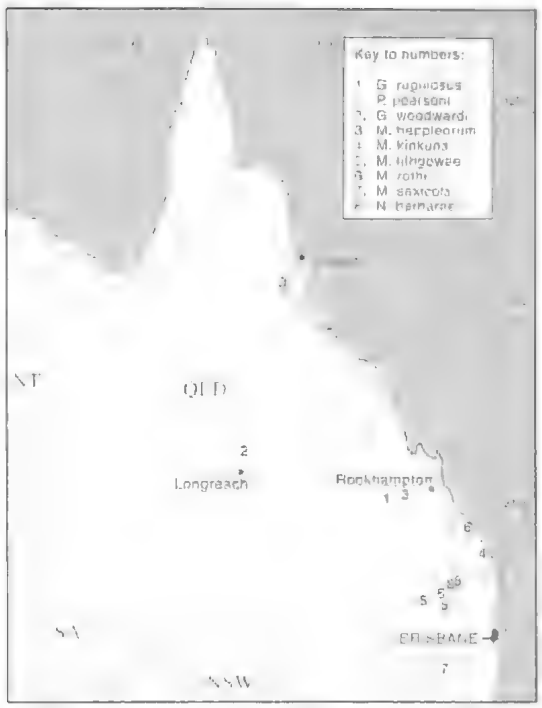

FIG. 1. Distribution of the 9 new species.

DISTRIBUTION AND BIOLOGY

This species occurs at two locations on the Blackdown Tableland. Blackdown Base has a loose grey sandy soil with *Eucalyptus*. Expedition Range has open *Eucalyptus* forest with an under cover of mostly quinine bushes on a fine orange loam.

REMARKS

In the subfamily, this species has the most matt texture and is most dorsoventrally compressed. Males are easily distinguished from the other *Geoscapheus* by their single pronotal tubercle.

ETYMOLOGY

Latin *rugulosus*, minutely wrinkled.

Geoscapheus woodwardi sp. nov.
(Figs 3A,B; 4A,B)

MATERIAL EXAMINED

HOLOTYPE: ♂, Mt Cornish, 7km NE of Muttaburra, 22°34'S 144°35'E, dug up, 23.vi.1992, BRR, HAR, JAW, JRW, QM.

PARATYPES: 2 ♂, 1 ♀, same data as holotype, QM; 1 ♂, 1 ♀, same data as holotype, ANIC.

OTHER MATERIAL: Queensland: 2 ♀, 4 ♂ nymphs, 5 ♀ nymphs, same data as holotype, USIC; 4 nymphs, Muttaburra, 13-16.X.1968, G.B. Monteith.

DESCRIPTION

Male

Colour. Head and antennae black; pronotum black anteriorly and medially, cream to castaneous posterolaterally, posterolateral punctations often brown or black, lateral and posterior margins black; meso- and metanotum cream to light tan, castaneous flecks and patches medially, a short castaneous to black longitudinal bar on anterior margin between midline and lateral margin, lateral and posterior margins black, ventral surfaces cream to light tan laterally, ventral surface of pronotum black, legs black, trochanters and anterior femoral margin light brown basally; tergites castaneous, anterior margins darker, supraanal plate castaneous; S2–6 castaneous laterally, dark brown to black medially; S7 castaneous, dark brown to black posteromedially; subgenital plate dark brown to black posteromedially; subgenital plate dark brown, anterior margin black; cerci black basally, castaneous to brown apically; dorsal and ventral surfaces shiny.

Measurements. Total length 37.5 (33.5–42.6), pronotal length x width 10.9 x 16.8 (9.9–11.1 x 15.5–18.4).

Head. Hidden under pronotum, finely punctate.

Thorax. Pronotum convex, subsemicircular, anterior margin curved obliquely upwards medially; disc depressed 2–3mm from anterior margin to 3-4mm from posterior margin, floor of depression granular and with a pair of oblique anterior grooves, posterior portion of depression less granular and with a pair of blunt disc tubercles (Fig.4B); pronotum finely punctate; meso- and metanotum finely and sparsely punctate, punctations denser laterally, lateral margins often with fine hairs; anteroventral margin of front femur with 3–4 large spines basally and usually a very small spine distally, posterior margin with a large distal spine.

Abdomen. T1–7 smooth to very weakly and sparsely punctate medially, weakly punctate laterally; laterocaudal angles of T2–5 broadly rounded and projecting slightly beyond lateral margin of previous tergite; laterocaudal angle of T6 produced into a short blunt spine directed obliquely and slightly dorsad (Fig.4A); laterocaudal angle of T7 produced into a short blunt spine directed obliquely and laterally (Fig. 4A); supraanal plate punctate, punctations denser posteriorly, laterocaudal angle hardly produced, posterior margin smooth; S2–5 punctate laterally,

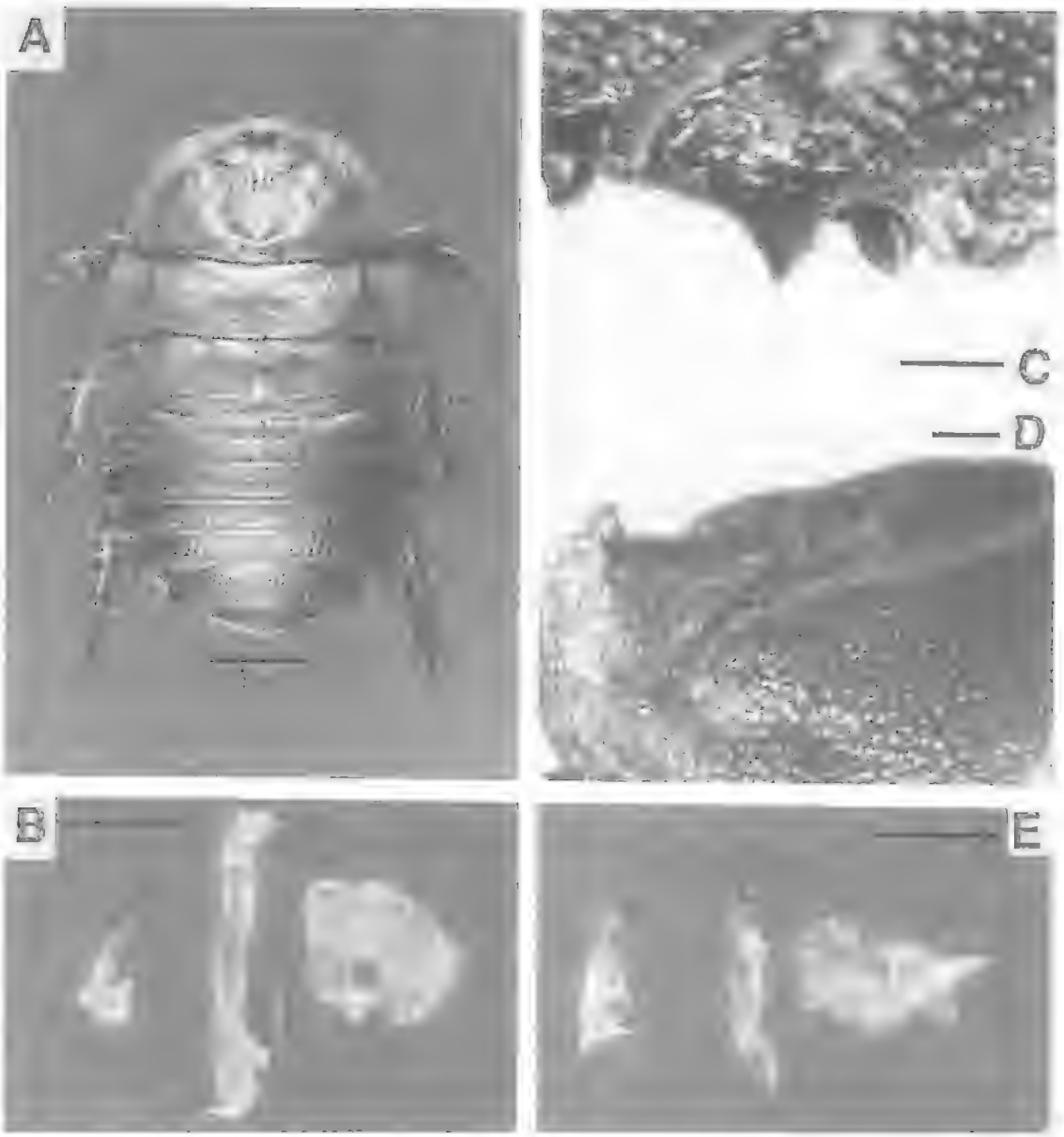

FIG. 2. *Geoscapheus rugulosus* sp. nov. A-D, holotype ♂; E, paratype ♂. A, habitus, dorsal view; B, genitalia, R2-L2vm-L1; C, laterocaudal angle of T6, lateral margin of T7, laterocaudal angle of supraanal plate, dorsal view; D, pronotum, lateral view; E, genitalia, R2-L2vm-L1.

sparsely punctate medially; S7 broadly rounded, concavely truncated posteriorly, punctate laterally and posteriorly, sparsely punctate anteromedially; subgenital plate punctate; cerci acutely triangular, tapering to a rounded point apically, dorsal surface smooth to finely and sparsely punctate, concave basally either side of a weak dorsal ridge, ventral surface slightly bulbous and densely setaceous medially; genitalia not fully developed, L2d absent, L2vm present, L1 absent or very weakly developed and hardly sclerotised, R2 ranges from an unsclerotised mound to a short sclerotised spur (Fig. 3B).

Female

Differs from male as follows: anterior margin

of pronotum less curved dorsally, disc less depressed, disc tubercles absent; lateral areas of pro-, meso- and metanotum tending towards yellowish brown or orange rather than cream; brown longitudinal bars on anterior margin of meso- and metanotum not as defined as in males; posterior margin of S7 convexly truncated posteriorly; no subgenital plate; larger than male.

Measurements. Total length 37.9–43.3, pronotal length x width 11.1–12.2 x 16.6–19.0.

Nymph

Similar to adult but without adult pronotal characters; cream on thoracic nota does not extend so far medially as in adults.

DISTRIBUTION AND BIOLOGY

Known only from the type locality in mixed open forest in sandy soil in overflow channels of the Thomson River. Most burrows were found below overhanging branches of *Acacia* spp.

REMARKS

This is the second species known which is bicoloured. Nymphs of this species are very similar to nymphs of *M. kraussiana*, possessing paleedged nota.

ETYMOLOGY

For Jim Woodward who assisted in the field.

Macropanesthia heppleorum sp. nov.
(Figs 3C,D; 4C,D)

MATERIAL EXAMINED

HOLOTYPE: ♂, Pine Trees Pony Stud, 10km E of Innot Hot Springs, Queensland, 17°40'S 145°14'E, dug up, 23.ii.1991, B. Hepple, QM.

PARATYPES: 1 ♂, 1 ♀, same location as holotype, dug up, 17.xi.1987, HAR, QM; 1 ♂, same location as holotype, dug up, 17.xi.1987, HAR, ANIC; 1 ♀, same data as holotype, ANIC.

OTHER MATERIAL: 2 ♂, 2 ♀, same data as holotype, USIC; 9 ♂, 10 ♀, 1 ♂ nymph, same location as holotype, dug up, 17.xi.1987, HAR, USIC; 2 ♀, 1 ♂ nymph, same location as holotype, dug up, 7.ii.1989, B. Hepple, USIC; 1 ♂, 2 ♂ nymphs, 1 ♀ nymph, same location as holotype, dug up, 27.ix.1992, HAR, JAW, USIC; 5 ♂, 2 ♀, 1 ♂ nymph, 2 ♀ nymphs, 'Yarra' 20km NE of Duaringa, dug up, 2.i.1989, G. Smith, USIC; 7 ♂, 1 ♀, 'Yarra' 20km NE of Duaringa, dug up, 1.ii.1989, G. Smith, USIC; 2 ♂, 1 ♀, 1 ♀ nymph, 'Yarra' 20km NE of Duaringa, dug up, 1.iii.1989, G. Smith, USIC; 1 ♂, Gogango, via Rockhampton, 12.viii.1967, C. Chopping, UQIC.

DESCRIPTION

Male

Colour. Head dark brown to black, clypeus pale brown apically; pronotum ferrugineous laterally and posteromedially, dark brown to black anteriorly and medially; meso- and metanotum ferrugineous, dark brown posterolaterally; legs tan to ferrugineous, tibia spines and tarsi dark brown to black; abdominal tergites ferrugineous to dark brown; supraanal plate dark brown to black; S2–6 tan to ferrugineous medially, dark brown to black laterally, S7 ferrugineous anteromedially, dark brown to black laterally and posteriorly; subgenital plate ferrugineous to dark brown; cerci dark brown basally, light brown apically; dorsal and ventral surfaces shiny.

Measurements. Total length 48.9 (49.9–51.9), pronotal length x width 13.5 x 21.0 (14.4–14.5 x 20.4–20.8).

Head. Finely and sparsely punctate, hidden under pronotum, frons slightly depressed above clypeus.

Thorax. Pronotum convex, subsemicircular, anterior margin slightly thickened and upturned (Fig. 4D), disc depressed weakly anterior to a pair of oblique anterior grooves arising from the centre of the pronotum, floor of depression roughened and granular, a pair of feeble separated disc tubercles present posterior to oblique grooves, finely and sparsely punctate posteriorly and laterally; meso- and metanotum finely and sparsely punctate, punctations stronger laterally; anteroventral margin of front femur with 2–3 large spines basally and a small spine distally, posterior margin with a large distal spine.

Abdomen. T1–6 smooth to very finely and sparsely punctate medially; T2–6 punctate laterally with stronger punctations in anterior corners, a row of punctations extending along anterior margin but not medially, punctations becoming slightly stronger and denser in posterior tergites; lateral margins of T7 concave, laterocaudal angle produced into a large acute spine strongly reflexed dorsally (Fig.4C); supraanal plate punctate, anterior margin smooth, laterocaudal angle slightly produced obtusely, posterior margin slightly upturned and entire or weakly undulate; S2–6 punctate laterally, smooth medially; S7 punctate laterally and posteriorly, smooth anteromedially, broadly rounded and concavely truncated posteriorly exposing subgenital plate; subgenital plate punctate; cerci bulbous, with a broadly rounded tip, densely setaceous ventrally, dorsal surface nonsetose except apical margins

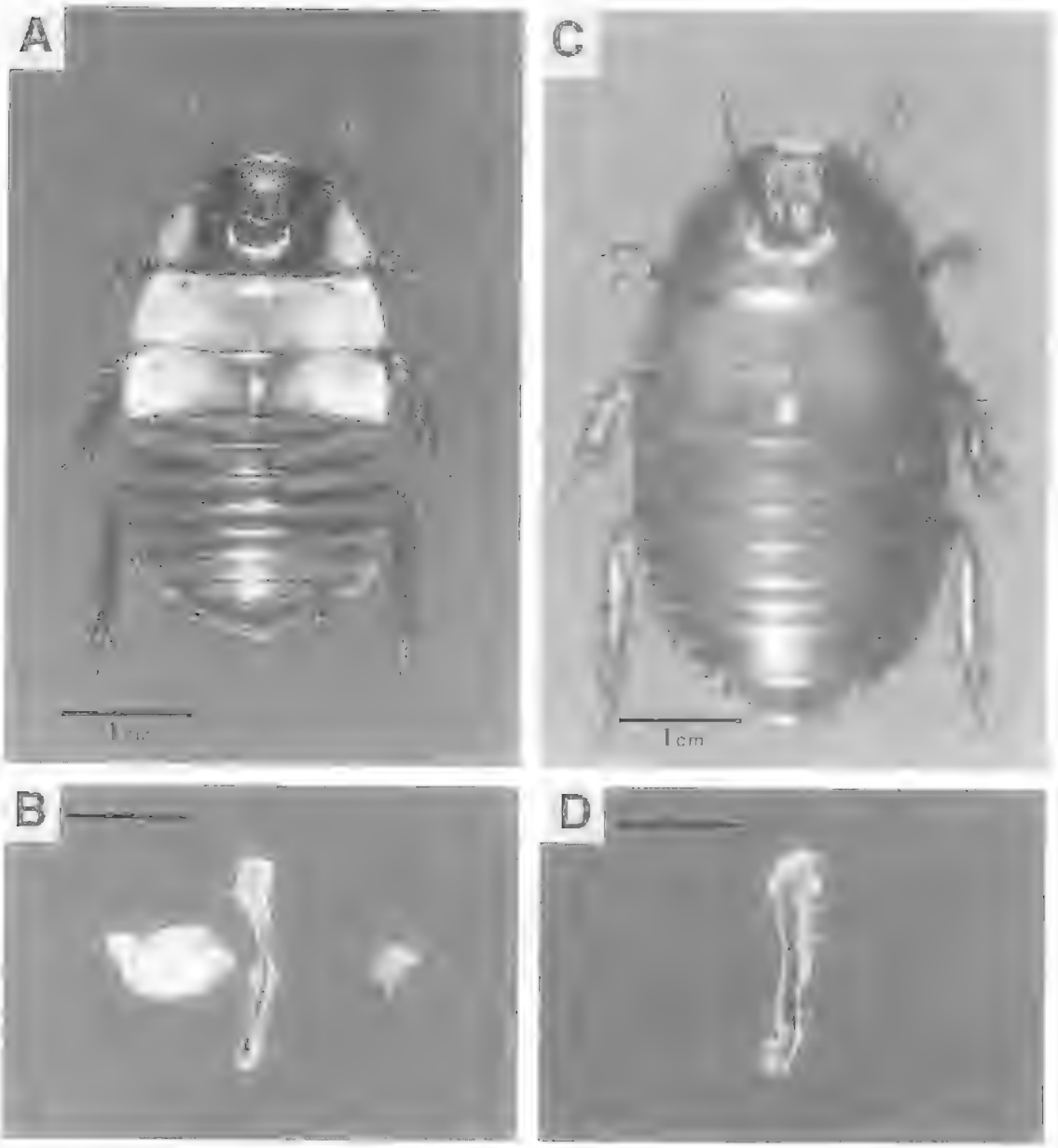

FIG. 3. A,B, *Geoscapheus woodwardi* sp. nov., holotype ♂; C,D, *Macropanesthia heppleorum* sp. nov., holotype ♂. A-C, habitus, dorsal view; B, genitalia, L1-L2vm-R2; D, genitalia, L2vm.

and with a weak medial ridge; genitalia reduced, L2d, L1 and R2 absent, L2vm present (Fig. 3D).

Female

Differs from male as follows: pronotum without disc tubercles, anterior margin only slightly thickened and upturned, disc only slightly depressed; S7 broadly rounded but not concavely truncated posteriorly; subgenital plate absent.

Measurements. Total length 45.7–48.2, pronotal length x width 12.2–12.8 x 18.8–20.1.

Nymph

Similar to adults but without adult pronotal

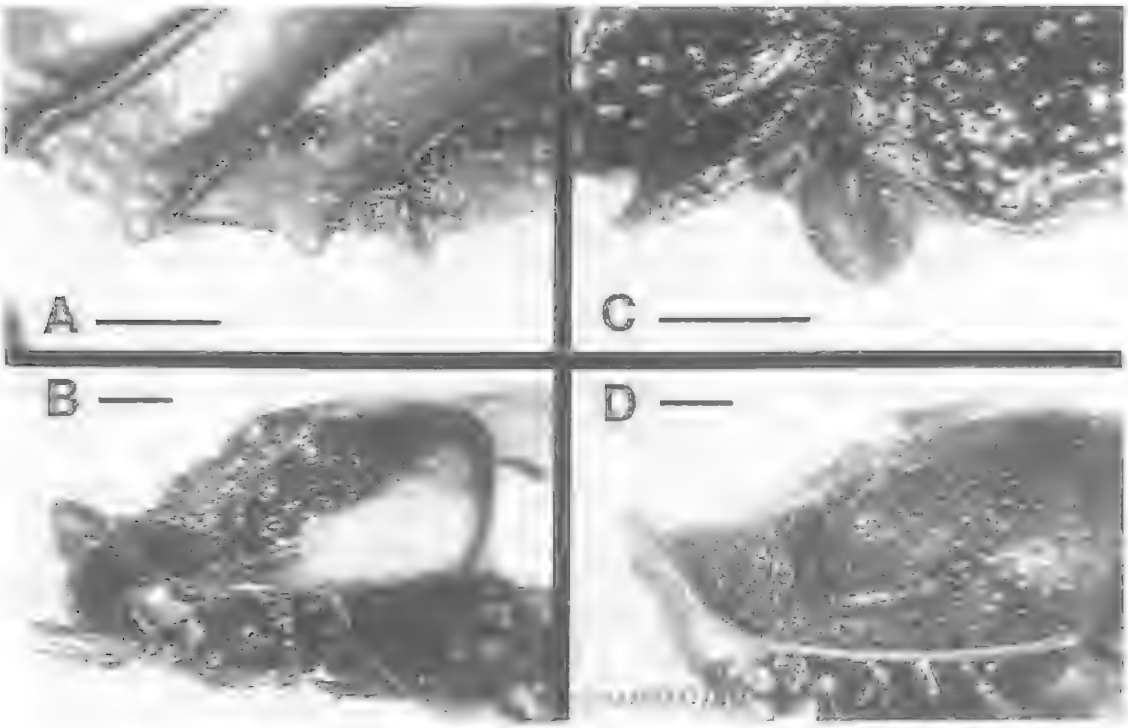

FIG. 4. A,B, *Geoscapheus woodwardi* sp. nov., holotype ♂; C,D, *Macropanesthia heppleorum* sp. nov., holotype ♂. A,C, lateral margins of T6-T7 supraanal plate, dorsal view; B, D, pronotum, lateral view.

characters; laterocaudal angle of T7 not as produced or reflexed.

DISTRIBUTION AND BIOLOGY

M. heppleorum is known from two widely separated areas; the population near Mt Garnet is 800km N of those around Duaringa. Specimens have been dug from grey sandy loams to hard packed red soil amongst brigalow roots. Vegetation is usually *Callitris–Eucalyptus* forest.

REMARKS

In both areas where *M.heppleorum* is found, *M. rhinoceros* is nearby but not sympatric. This species is similar to *M. rhinoceros* but smaller. The Gogango specimen (C. Chopping, 1967, UQIC) was identified by L.M. Roth in 1974 as a male nymph of *M. rhinoceros*. It is, however, an adult and similar to those specimens from 'Yarra', 20km NE of Duaringa.

Adult males can be distinguished from small specimens of *M. rhinoceros* by having less pronotal development, disc tubercles are smaller and the anterior margin less dorsally curved. A further distinction of *M. rhinoceros* is its adult pronotal length of greater than 15mm versus less than 15mm for *M. heppleorum*.

ETYMOLOGY

For Don and Betty Hepple on whose former property this species is abundant.

Macropanesthia kinkuna sp. nov.
(Figs 5A–D; 6A,B)

MATERIAL EXAMINED

HOLOTYPE: ♂, Kinkuna National Park 15km SE of Bundaberg, Queensland, 25°00'S 152°29'E, dug up, 21.iv.1992, D. Cook, G. B. Monteith, QM.

PARATYPES: 1 ♂, same data as holotype, ANIC; 1 ♂, 10km S of Gotlow, 25°00'S 152°23'E, dug up. 5.vii.1992, HAR, JAW, JRW, QM; 1 ♂, 10km S of Gotlow, 25°00'S 152°23'E, dug up, 5.vii.1992, HAR, JAW, JRW, ANIC; 1 ♂, 1 ♀, Coonarr Beach, 10km S of Bundaberg, 25°55'S 152°29'E, dug up, 6.vii.1992, HAR, JAW, JRW, QM.

OTHER MATERIAL: 1 ♂, 1 ♀, 2 ♂ nymphs, same data as holotype, USIC; 5 ♂, 1 ♀, 3 ♂ nymphs, 5 ♀ nymphs, same data as Coonarr Beach paratypes, USIC; 3 ♂ nymphs, same data as Gotlow paratypes, USIC.

DESCRIPTION

Male

Colour. Head ferrugineous, frons genae and mandibles black, clypeus tan apically; pronotum ferrugineous laterally, dark brown to black medially; meso- and metanotum ferrugineous; legs dark tan to ferrugineous, tibia darker; abdominal T1 ferrugineous, T2–7 dark brown to black; supraanal plate black; S2–6 dark tan medially, black laterally; S7 dark brown to black, brown anteromedially; subgenital plate dark brown; cerci ferrugineous apically and on dorsal medial ridge, dark brown to black dorsobasally either side of medial ridge, light brown ventrobasally; pro-, meso- and metanotum shiny; T1–6 shiny; T7 and supraanal plate matt; ventral surface shiny.

Measurements. Total length 41.2 (32.2–41.8), pronotal length x width 11.0 x 18.5 (8.9–11.6 x 14.9–18.7).

Head. Projecting slightly beyond pronotum, smooth, frons slightly depressed above clypeus.

Thorax. Pronotum very finely and sparsely punctate laterally, convex subsemicircular, with a medial premarginal thickening forming a rounded tubercle (Fig. 5D); disc depressed posterior to tubercle to 2–3mm from posterior margin which is thickened medially, floor of depression finely granular posterior to premarginal tubercle and anterior to a pair of oblique anterior grooves, slightly roughened posterior to oblique anterior grooves; meso- and metanotum with very fine sparse punctations; anteroventral margin of front femur with 2–4 large spines basally, a very small and often absent spine distally; posterior margin of front femur with a large distal spine.

Abdomen. T1 smooth; T2–6 with punctations laterally, punctations becoming stronger from T2 to T6, medial punctations becoming stronger and denser from T2–6 with T2 being very finely and sparsely punctate and T6 strongly and densely punctate; laterocaudal angle of T6 slightly produced forming a small caudally directed spine; T7 strongly and densely punctate, laterocaudal angle produced into an acute oblique spine curved dorsally (Fig. 5C); T6 and T7 (sometimes T5) with anterolateral holes (Fig. 6B); supraanal plate strongly and densely punctate over all but anterior margin which is smooth; laterocaudal angle of supraanal plate produced acutely, rounded apically, with convex outer margins and concave inner margins, posterior margin strongly crenulate (Fig. 6A); S2-6 punctate laterally, smooth to very weakly and sparsely punctate medially; S7 broadly rounded, punctate laterally and posteromedially, smooth anteromedially, transversely to weakly concavely truncated posteriorly exposing subgenital plate; subgenital plate finely punctate; cerci bulbous and densely; setaceous ventrally (Fig. 5C), tapering to an acute tip apically, dorsal surface smooth to sparsely and very finely punctate, concave basally either side of a strong dorsal medial ridge; genitalia developed, L2d absent, L2vm and L1 present, R2 developed into a full hook (Fig. 5B).

Female

Differs from male as follows: pronotum, anterior margin only slightly thickened, tubercle weak, disc depression posterior to oblique grooves less pronounced, posterior margin not thickened; S7 not concavely truncated posteriorly; no subgenital plate.

Measurements. Total length 36.4–39.0, pronotal length x width 9.5–10.2 x 15.8–18.0.

Nymph

Similar to adult but without adult pronotal characters.

DISTRIBUTION AND BIOLOGY

From 3 locations within a few km in or near Kinkuna National Park. It is found in grey sandy loam amongst *Eucalyptus/Banksia* forest, *Casuarina* stands, *Callitris*, and thick heath.

REMARKS

Although superficially similar to *M. mackerassae* this species is distinguished on its crenulate supraanal plate margins

ETYMOLOGY

For Kinkuna National Park.

Macropanesthia kraussiana (Saussure)
(Fig. 5E)

MATERIAL EXAMINED

LECTOTYPE: ♂, Melbourne, Victoria, in the Geneva Museum (not examined).

OTHER MATERIAL: Queensland: 1 ♂, 1 ♀, 1 ♂ nymph, Isisford, sand ridge on road to 'Mons' homestead, dug up, 20.ix.1990, G. Lithgow, USIC; 3 ♂, 3 ♀, 4 ♂ nymphs, 8 ♀ nymphs, 'Mons' 5km S of Isisford, 24°18'S 144°26'E, dug up, 21.vi.1992, BRR, HAR, JAW, JRW, USIC. New South Wales: 1 ♀ nymph, MMUS; 1 ♀, Caltigeena Creek, dug up, ix.1988, HAR, USIC; 1 ♀, 77km W of Cobar, 6.xi.1990, HAR, USIC;

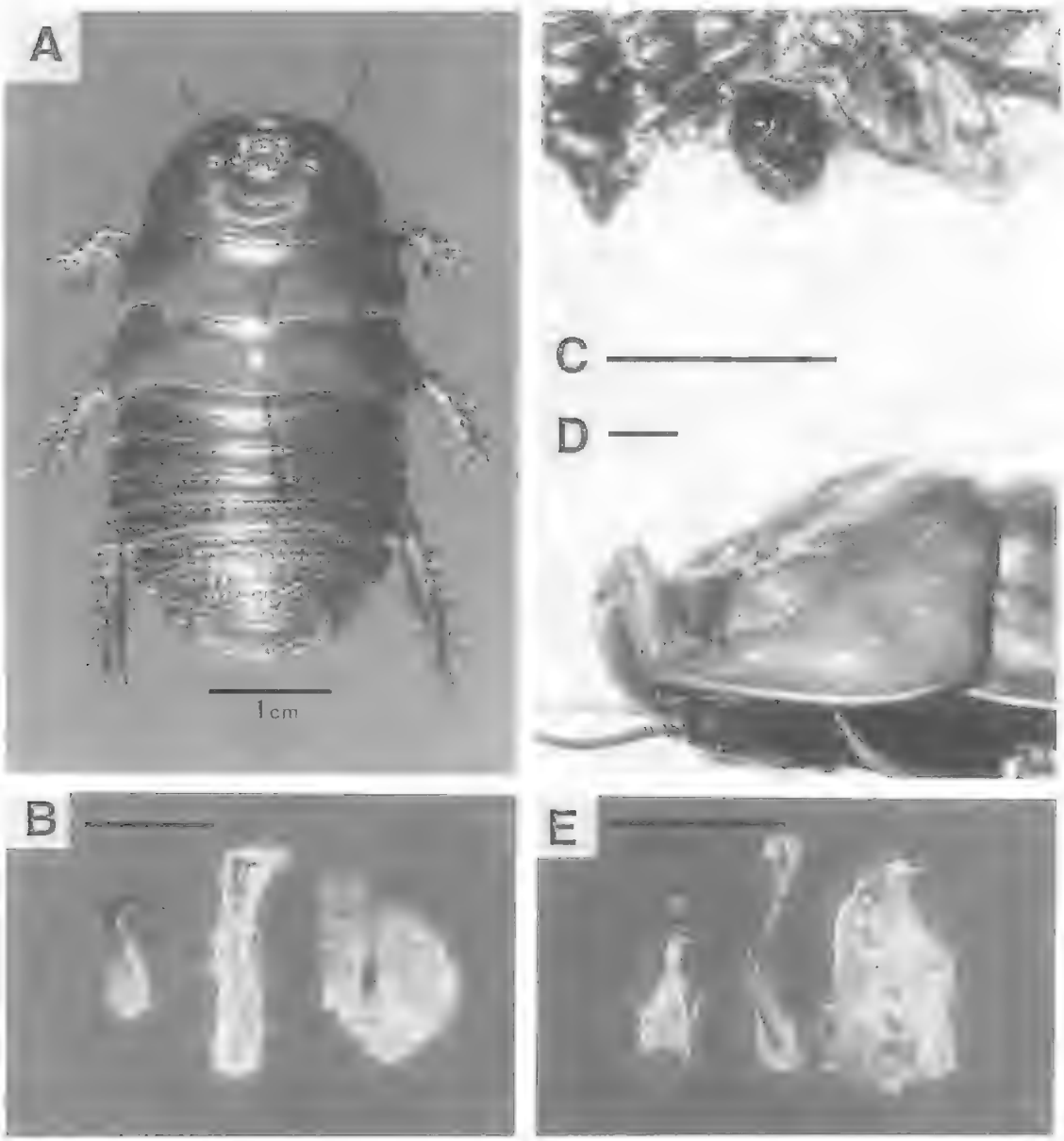

FIG. 5. A-D, *Macropanesthia kinkuna* sp. nov., holotype ♂; E, *Macropanesthia kraussiana* (Saussure), ♂ Mons, Queensland. A, habitus, dorsal view; B,E, genitalia, R2-L2vm-L1; C, laterocaudal angle of T7, lateral margin of supraanal plate, dorsal view; D, pronotum, lateral view.

2 ♀, 3 ♂ nymphs, 3 ♀ nymphs, NW edge of Lake Popiltah, 33°08'S 141°43'E, dug up, 8.xi.1990, HAR, USIC.

MALE GENITALIA

Much reduced. L2d is absent and L2vm present. L1 is weakly developed and is present only as a weakly sclerotised line. R2 is a short weakly sclerotised spur or may be absent (Fig. 5E).

REMARKS

When the Panesthiinae were revised by Roth (1977) he examined three specimens, from Rockhampton, New South Wales and Melbourne. He concluded *M. kraussiana* had a wide distribution.

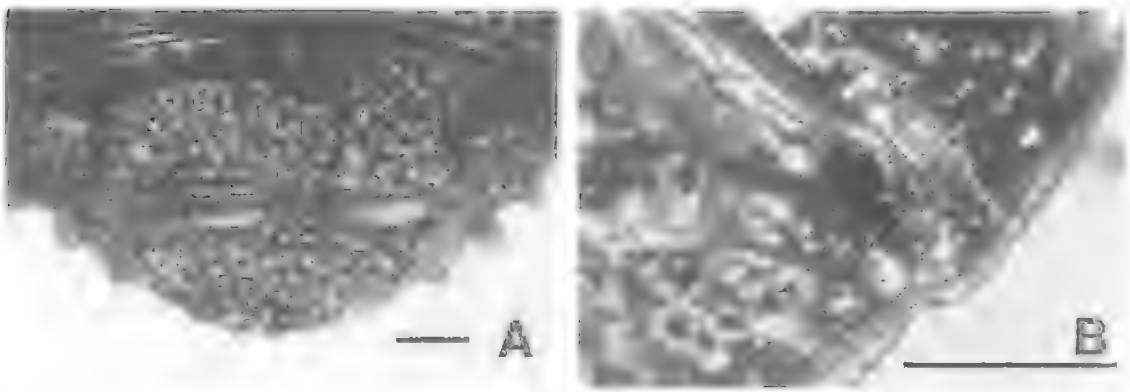

FIG. 6. *Macropanesthia kinkuna* sp. nov., holotype ♂, dorsal view. A, T7 and supraanal plate; B, lateral portion of anterior margin of T6.

Melbourne seems an unlikely habitat for this species since all other known records are in semi-arid areas. Nevertheless, it ranges over wide areas in Queensland and New South Wales.

Macropanesthia lithgowae sp. nov.
(Figs 7A,B; 8A-C)

MATERIAL EXAMINED

HOLOTYPE: ♂, Nudley State Forest, 20km N of Jandowae, 26°32'S 151°00'E, dug up, 18.xii.1986, HAR, JRW, QM.

PARATYPES: 1 ♀, 'Allinga' Homestead, 8km N of Chinchilla, 26°41'S 150°38'E, dug up, 11.iv.1988, G. Lithgow, ANIC; 1 ♂, same location as holotype, dug up, 3.vii.1992, BRR, HAR, JAW, JRW, ANIC; 1 ♀, same location as holotype, dug up, 3.vii.1992, BRR, HAR, JAW, JRW, QM; 1 ♂, 1 ♀, Jinghi Valley Road, 9km N of Jandowae, 26°41'S 151°05'E, dug up, 4.vii.1992, BRR, HAR, JAW, JRW, QM.

OTHER MATERIAL: 1 ♂, 2 ♀, 1 ♂ nymph, same location as holotype, dug up, 20.xii.1987, HAR, USIC; 1 ♂, Chinchilla, dug up, xii.1987, HAR, USIC; 1 ♂, 4 ♀, same location as holotype, dug up, 12-13.v.1988, HAR, USIC; 1 ♂, 2 ♀, 5 ♂ nymphs, 5 ♀ nymphs, laboratory born from adults collected at holotype location, HAR, USIC; 3 ♂, 5 ♀, same location as holotype, dug up, 26.ii.1988, HAR, JRW, USIC; 1 ♂, 1 ♀, same location as holotype, dug up, 18.xii.1986, HAR, JRW, USIC; 2 ♂, 5 ♀, 3 ♂ nymphs, 1 ♀ nymph, same location as holotype, dug up, 3.vii.1992, BRR, HAR, JAW, JRW, USIC; 1 ♂ nymph, 'Gilgunya' Nudley State Forest, dug up, 3.vii.1992, JAW, USIC; 1 ♂, 1 ♀, 4 ♂ nymphs, 4 ♀ nymphs, Jinghi Valley Road, 9km N of Jandowae, 26°41'S 151°05'E, dug up, 4.vii.1992, BRR, HAR, JAW, JRW, USIC; 1 ♂, 1 ♀, Jinghi Valley Road, 9km N of Jandowae, 26°41'S 151°05'E, dug up, 14.v.1988, HAR, USIC; 2 ♀, 2 ♂ nymphs, 2 ♀ nymphs, Monmouth, 4km NE of Chinchilla, dug up, 23.iv.1988, HAR, USIC; 3 ♂, 2 ♀, 1 ♂ nymph, 'Allinga' Homestead, 8km N of Chinchilla, 26°41'S 150°38'E, dug up, 13.v.1988, HAR, USIC.

DESCRIPTION

Male

Colour. Head dark brown to black, vertex slightly ferrugineous; pronotum ferrugineous laterally and along posterior margin, dark brown anteromedially and around disc; meso- and metanotum ferrugineous; coxae, tibia, profemora and tarsi dark brown; trochanters meso- and metafemurs light brown; tergites and supraanal plate ferrugineous to dark brown; S2–6 dark brown to black laterally, ferrugineous to brown medially; S7 dark brown to black, brown anteromedially; subgenital plate dark brown; cerci ferrugineous; dorsal and ventral surfaces shiny.

Measurements. Total length 46.0 (41.2–42.3), pronotal length x width 11.9 x 18.1 (11.0 x 16.8–18.3).

Head. Weakly and very finely punctate, hidden under pronotum, depressed above clypeus.

Thorax. Pronotum convex, subsemicircular; anterior margin often slightly indented medially, with a premarginal thickening forming a pair of slightly recurved rounded tubercles (Fig.8B); disc depressed posterior to tubercles to 2–3mm from posterior margin; floor of depression roughened and slightly transversely striate immediately posterior to tubercles, with a pair of oblique anterior grooves meeting in centre of disc depression, often with two very weak tubercles immediately anterior to junction of oblique grooves; finely punctate anteriorly adjacent to premarginal tubercles and laterally, smooth

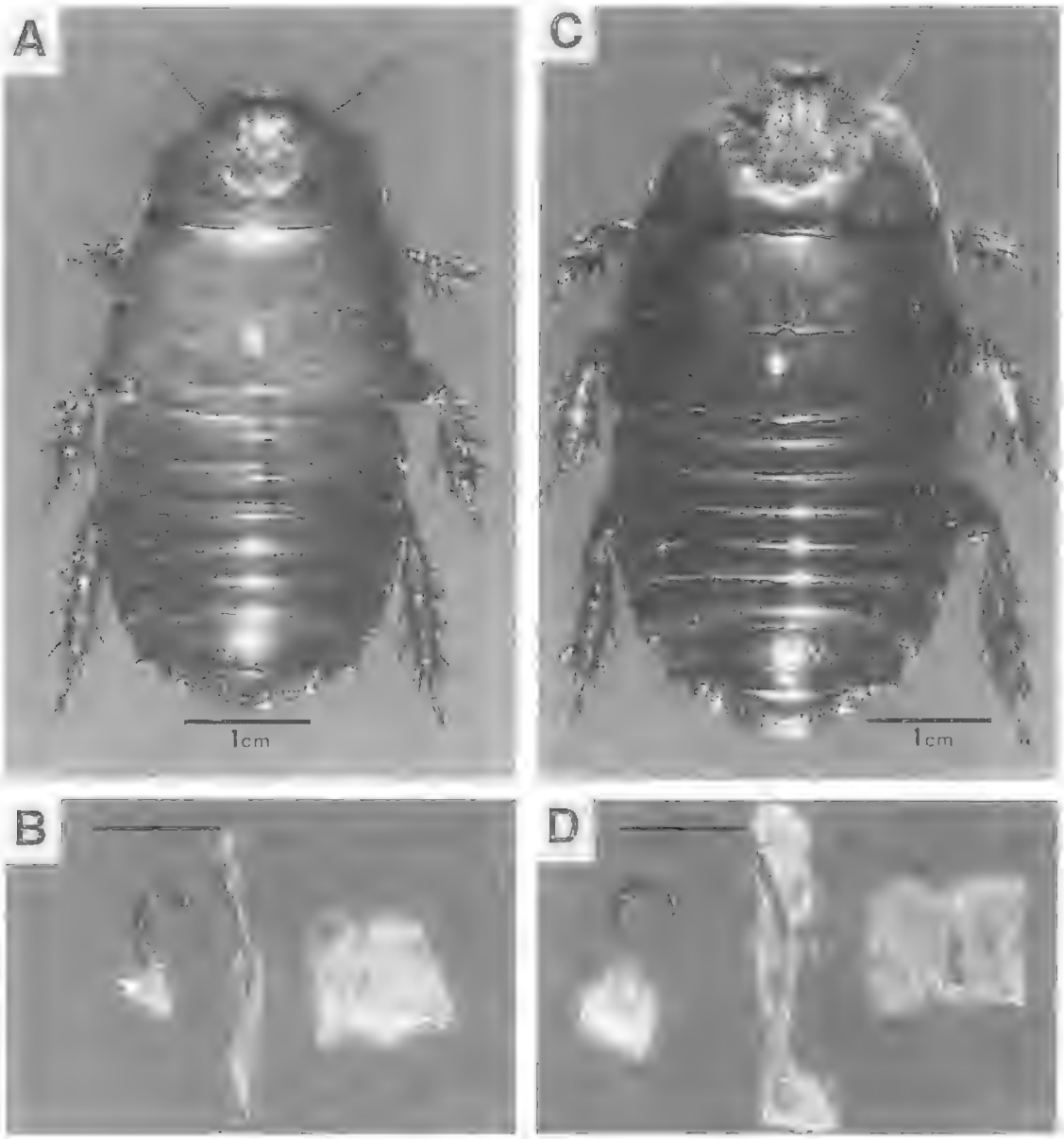

FIG. 7. A,B, *Macropanesthia lithgowae* sp. nov., holotype ♂; C,D, *Macropanesthia montcithi* Roth, ♂ Hivesville, Queensland. A,C, habitus, dorsal view; B,D, genitalia, R2-L2vm-L1.

posteromedially; meso– and metanotum smooth to very weakly and sparsely punctate laterally; anteroventral margin of front femur with 2–4 (usually 3) large spines basally and a small spine distally, posterior margin with a large distal spine.

Abdomen. T2–5 punctate laterally, T2–4 being weaker, smooth to very finely and sparsely punctate medially; T6 punctate laterally becoming sparse and fine medially, posterior margin thickened laterally producing a broadly rounded ridge ending before lateral margin (Fig. 8C); T7 punctate except on anteromedial margin, laterocaudal angle produced into an acute spine directed obliquely and curved dorsally (Fig. 8A); supraanal plate punctate except anteromedially, laterocaudal angle slightly produced forming a broadly rounded obtuse spine directed caudally, posterior margin smooth; S2–6 strongly and den-

sely punctate laterally, S3–6 very finely and sparsely punctate to smooth medially; S7 strongly punctate laterally, weakly punctate posteriorly, smooth anteromedially, broadly rounded, concavely truncated posteriorly exposing subgenital plate; subgenital plate smooth; cerci broadly triangular with a rounded tip, dorsal surface nonsetose and with a medial ridge basally, setaceous ventrally except on apical margins; genitalia well developed, L2d absent, L2vm and L1 present, R2 developed into a strong sclerotised hook (Fig. 7B).

Female

Differs from male as follows: pronotum without premarginal tubercles, disc less depressed; S7 broadly rounded but not concavely truncated posteriorly; subgenital plate absent.

Measurements. Total length 37.0-42.1, pronotal length x width 9.6-10.9 x 16.1-17.3.

Nymph

Similar to adults but without adult pronotal characters (disc depression and tubercles).

DISTRIBUTION AND BIOLOGY

Common in the Chinchilla and Jandowae areas: *N. hirsutus* occurs at Burra Burri, only a few km from *M. lithgowae* in Nudley State Forest. Some areas have high population densities with more than one burrow/m^2. It occurs in sandy loamy soil in open sclerophyll forests with *Eucalyptus* and *Callitris*.

REMARKS

Although similar to *N. hirsutus* it lacks the rounded tubercle.

ETYMOLOGY

For Grace Lithgow, a naturalist, on whose property the species occurs.

Macropanesthia monteithi Roth
(Figs 7C,D; 8D–F)

MATERIAL EXAMINED

HOLOTYPE: ♀, Stonelands, Qld., 1.iii.1964, B. Genn, MT.7212.

PARATYPE: ♂, Sydney, A. & F. R. Zietz, SAM.

OTHER MATERIAL: Queensland: 3 ♂, Hivesville, dug up, 25.i.1992, HAR, USIC; 2 ♂, 1 ♂ nymph, Archookoora St. For. 23km S of Kingaroy, dug up, 26.viii.1986, HAR, USIC; 13 ♂, 7 ♀, 5 ♂ nymphs, 4 ♀ nymphs, Archookoora St. For. 23km S of Kingaroy, dug up, 26.i.1992, HAR, USIC; 1 ♂, 3.5km NE of Proston, on surface, iv.1992, C. Kilgour, USIC.

DESCRIPTION

Male

Colour. Head ferruginous to black, frons and clypeus black; pronotum dark brown to black, disc black, meso- and metanotum ferrugineous to dark brown medially, dark brown to black laterally; legs black, femurs ferrugineous basally; tergites dark brown to black; sternites black laterally, ferrugineous to dark brown medially; subgenital plate dark brown to black; cerci dark brown to black; ventral and dorsal surfaces shiny.

Measurements. (all males examined), total length 40.2–51.6, pronotal length x width 12.3-14.4 x 18.6–23.0.

Head. Hidden under pronotum, finely punctate.

Thorax. Pronotum convex, anterior margin indented medially, with a premarginal thickening forming a pair of rounded tubercles which are often recurved (Fig. 8E), disc depressed posterior to tubercles to 2–3mm from posterior margin, floor of depression roughened and granular and with a pair of transverse curved grooves becoming oblique then meeting in centre of disc depression, with two distinct disc tubercles on the posterolateral margin of the disc depression, remainder of pronotum smooth to finely and weakly punctate; meso- and metanotum smooth to weakly and sparsely punctate; anteroventral margin of front femur with 3–4 (rarely 5) large spines basally and a very small spine distally, posterior margin with a small distal spine.

Abdomen. T1 smooth; T2–6 smooth to finely and weakly punctate medially and weakly punctate laterally, posterior margin of T6 thickened and raised laterally forming a ridge which tapers to the lateral margin (Fig. 8F); T7 weakly punctate, lateral margin concave, laterocaudal angle produced into an acute spine directed laterally (Fig. 8D); supraanal plate punctate except medially on anterior and posterior margins, posterior margin often slightly curved upwards and may be smooth or weakly crenulate, laterocaudal angle weakly produced and broadly rounded; S2-6 smooth medially, punctate laterally; S7 smooth medially, punctate laterally, often weakly punctate posteromedially, weakly concavely truncated posteriorly exposing subgenital plate; subgenital plate smooth; cerci broadly triangular, rounded apically, with a strong dorsal medial ridge, bulbous and densely setose ventrally, setose on posterior margin, nonsetose dorsally; genitalia well developed, L2d absent, L2vm

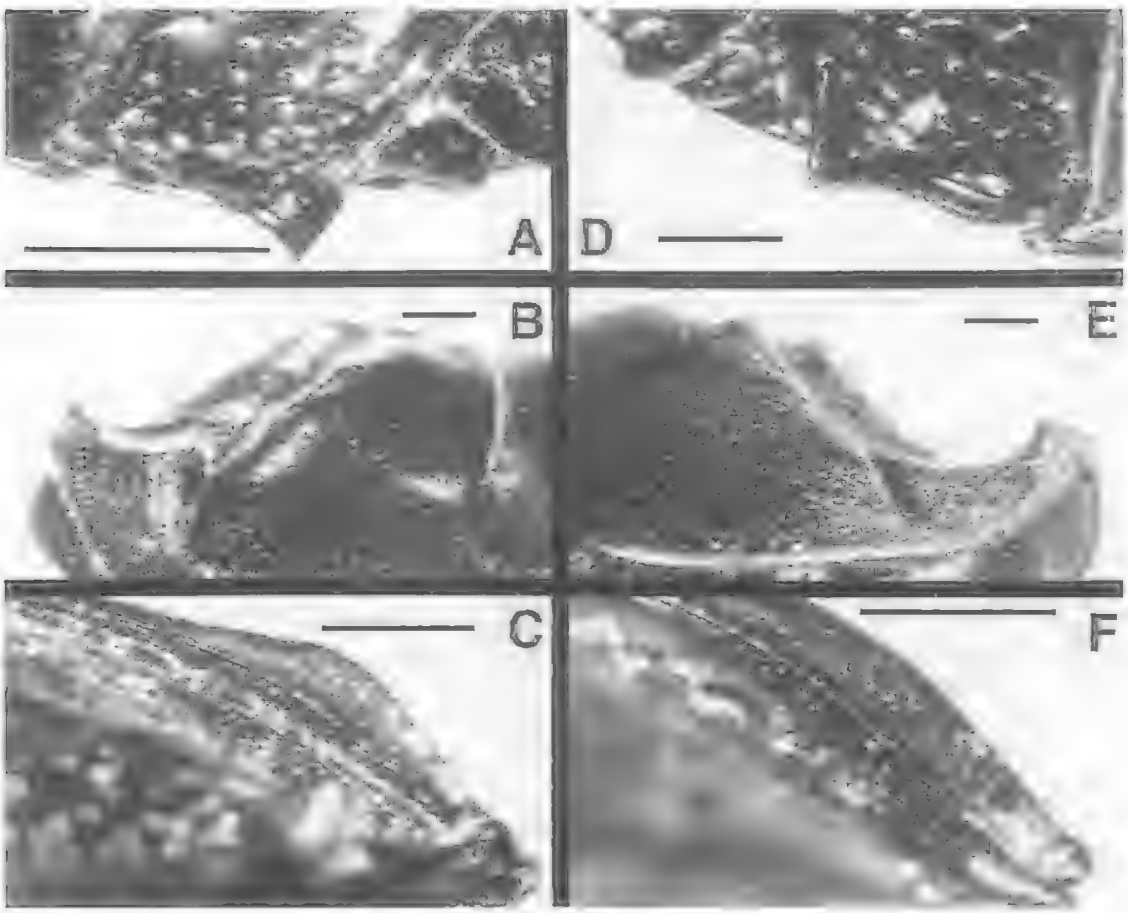

FIG. 8. A–C, *Macropanesthia lithgowae* sp. nov., holotype ♂; D-F, *Macropanesthia monteithi* Roth, ♂ Hivesville, Queensland. A,D, laterocaudal angle of T6, lateral margin of T7, dorsal view; B,E, pronotum, lateral view; C,F, lateral portion of posterior margin of T6, posterior view.

and L1 present, R2 developed into a strong sclerotised hook (Fig. 7D).

DISTRIBUTION AND BIOLOGY

Two populations in SE Queensland. Archookoora State Forest and Hivesville both have softwood scrub with scattered evergreen vine thickets on a brown to red loam, however, Archookoora is slightly wetter.

REMARKS

The original description of *M. monteithi* Roth (1977) was from an adult female collected at Stonelands, near Hivesville, and a female from Sydney. The specimens on which the male description is based are from two populations around Kingaroy. The specimen from Sydney, designated by Roth (1977) as a paratype, is not an adult and differs from nymphs collected at the holotype location. Nymphs are extremely hard to identify as the pronotal and tergal features, which distinguish the various species, are not fully developed. The 'Sydney' nymph remains undetermined, however, it keys closest to *M. kinkuna* sp. nov.

Macropanesthia rothi sp. nov.
(Figs 9B–D; 10A)

MATERIAL EXAMINED

HOLOTYPE: ♂, Wreck Rock, 12km S of Agnes Water, 24°19'S, 151°58'E, dug up, 19-26.viii.1985, A. Kotze, HAR, DR, L. Sanchez, JRW, QM.

PARATYPES: 1 ♂, data as for holotype, QM; 1 ♂, 1 ♀, Wreck Rock, 12km S of Agnes Water, 24°19'S 151°58'E, dug up, 4.v.1989, HAR, DR, JRW, ANIC; 1 ♂, Wreck Rock, 12km S of Agnes Water, 24°19'S 151°58'E, dug up, 4.v.1989, HAR, DR, JRW, QM.

OTHER MATERIAL: Queensland: 1 ♂, 1 ♀, Rainforest Pitfall 71, Rocky Point, 10km S of Round Hill Head, 1976-1977, 60m, G.B. & S.R. Monteith, QM; 1 ♀, 10.8km S of Agnes Water, dug up, 9.xii.1986, HAR, DR, L. Sanchez, JRW, USIC; 7 ♂, 3 ♀, 4 ♂ nymphs, 1 ♀ nymph, data as for holotype, USIC; 1 ♀, 2 ♂ nymphs, 1 ♀ nymph, 10.8km S of Agnes Water, dug up, 9-12.xii.1986, HAR, DR, L. Sanchez, JRW, USIC; 3 ♂, 10.8km S of Agnes Water, dug up, 14.ii.1988, HAR, DR, JRW, USIC; 1 ♀, Wreck Rock, 12km S of Agnes Water, 24°19'S 151°58'E, dug up, 4.v.1989, HAR, DR, JRW, USIC; 3 ♂, 6 ♀, 2 ♂ nymphs, 3 ♀ nymphs, Wreck Rock, 12km S of Agnes Water, 24°19'S 151°58'E, dug up, 3-5.iv.1991, A. C. Kotze, J. D. Redfern, HAR, JRW, USIC.

DESCRIPTION

Male

Colour. Head ferrugineous, frons gena and mandibles dark brown; pronotum ferrugineous laterally, dark brown to black medially; meso and metanotum ferrugineous laterally and posteriorly, dark brown anteromedially; legs ferrugineous, spines black apically; tergites progressing from ferrugineous to black from T1–7, T7 almost black; supraanal plate almost black, posterior margin ferrugineous; S1–6 lightly ferrugineous medially, dark brown laterally; S7 ferrugineous anteromedially, dark brown laterally and posteriorly; subgenital plate ferrugineous; cerci dark brown; ventral surfaces shiny; dorsal surfaces shiny anteriorly tending to matt posteriorly.

Measurements. Total length 68.3 (61.8–63.6), pronotal length x width 22.2 x 35.2 (17.5–20.0 x 28.9–32.5).

Head. Hidden under pronotum, sparsely and finely punctate, frons slightly depressed above clypeus.

Thorax. Pronotum convex, subsemicircular, with a medial premarginal thickening forming a pair of broadly rounded tubercles which are fused medially (Fig. 9C); disc depressed posterior to tubercles to 2–3mm from posterior margin which is thickened medially, floor of depression roughened and granular behind anterior tubercle and anterior to a pair of oblique anterior grooves, posterior portion of depression relatively smooth; pronotum sparsely and finely punctate, finely grooved laterally; meso- and metanotum with sparse fine punctations and fine irregular grooving; anteroventral margin of front femur with 2 or 3 (rarely 1 or 4) large spines basally, a small spine distally, hind margin with a large distal spine.

Abdomen. T1–4 sparsely punctate laterally, posterior margin of T2–3 (often T4) strongly concave laterally (Fig. 10A), T5 and T6 with stronger denser punctations extending medially; laterocaudal angle of T6 produced into a short acute blunt spine directed posteriorly (Fig. 9D); T7 with punctations larger and denser than on anterior tergites, laterocaudal angle produced into an acute spine directed ventrocaudally (Fig. 9D); supraanal plate punctate over all except anterior margin, laterocaudal angles produced obtusely, posterior margin smooth to weakly crenulate and weakly upturned; S7 punctate laterally and medially, broadly rounded, concavely truncated posteriorly exposing subgenital plate; cerci bulbous, broadly rounded, densely setaceous (Fig.9D); genitalia well developed but variable, L2d absent, L2vm and L1 present but often weak, R2 ranging from a weak unsclerotised spur to a fully developed hook (Fig.9B).

Female

Differs from male as follows: pronotum with anterior margin only slightly thickened, tubercles absent, disc only slightly depressed, posterior margin not thickened; S7 with posterior margin not truncated concavely, no subgenital plate.

Measurements. Total length 63.4–64.4, pronotal length x width 18.1 x 30.7–30.8.

Nymph

Similar to adult but without adult pronotal characters, body more dorsoventrally compressed than adult. Colour, pale tan to brown for early instars, becoming darker towards final instar, final instar with sternite and legs pale brown medially.

DISTRIBUTION AND BIOLOGY

Known from within and close to Deepwater National Park in sandy, open forest to rainforest, with palms and *Casuarina* predominating, and with some *Eucalyptus*.

REMARKS

This species is similar in size to *M. rhinoceros* but more robust in the thorax and legs.

ETYMOLOGY

For Dr L. M. Roth.

Macropanesthia saxicola sp. nov.
(Figs 9A,E–G; 10B)

MATERIAL EXAMINED

HOLOTYPE: ♂ Pikedale, 28°39'S 151°37'E, dug up, 7.xii.1991, HAR, QM.

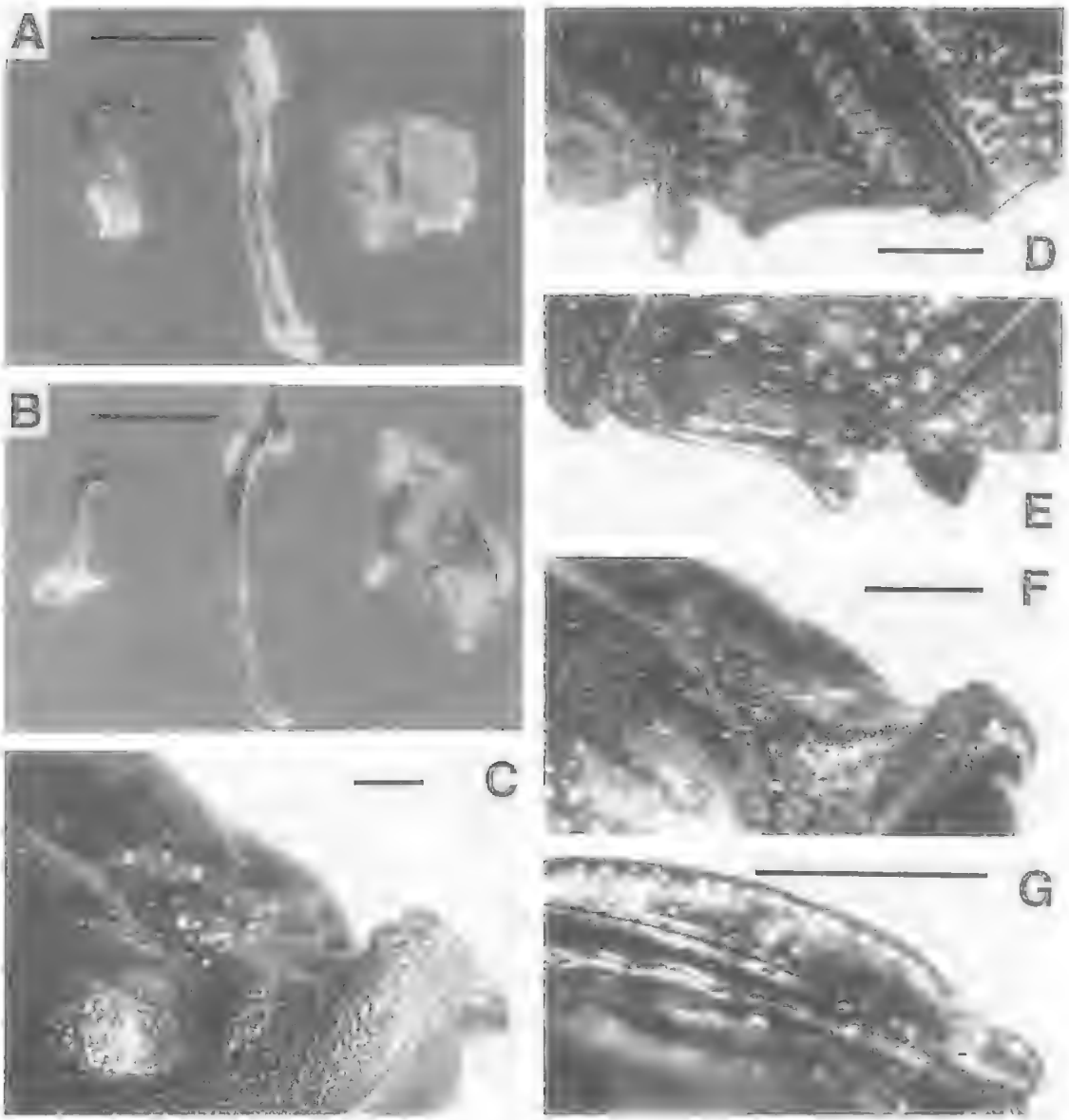

FIG. 9. A,E–G, *Macropanesthia saxicola* sp. nov., holotype ♂; B-D, *Macropanesthia rothi* sp. nov., holotype ♂. A,B, genitalia, R2-L2vm-L1; C,F, pronotum, lateral view; D,E, laterocaudal angles of T6 and supraanal plate, lateral margin of T7, dorsal view.

PARATYPES: 1 ♂, 1 ♀, same data as holotype, ANIC; 1 ♂, same data as holotype, QM; 1 ♀, Pikedale nr Texas, in grass beside road, 20.x.1990, G. Grigg, QM. OTHER MATERIAL: Queensland: 3 ♀, 3 ♂ nymphs, 2 ♀ nymphs, same data as holotype, USIC.

DESCRIPTION

Male

Colour. Head black; pronotum black, dark brown to black laterally and posteriorly; meso- and metanotum black laterally, dark brown medially; legs black, meso- and metafemur brown posteroventrally; T1–7 dark brown to black tending darker from T1–7; supraanal plate dark brown to black; S2–6 black laterally, S3–6 brown medially; S7 black laterally, dark brown to black posteriorly, brown to black anteromedially; subgenital plate dark brown to

black; cerci black, usually ferrugineous on apical tip; dorsal and ventral surfaces shiny.

Measurements. Total length 38.5 (38.2–40.6), pronotal length x width 10.3 x 15.3 (10.3–10.5 x 16.0–16.4).

Head. Hidden under pronotum, finely and sparsely punctate, slightly depressed above clypeus.

Thorax. Pronotum convex, subsemicircular, finely punctate, anterior margin indented medially and thickened producing a pair of weak broadly rounded tubercles (Fig. 9F); disc depressed posterior to tubercles and 2–3mm anterior of slightly thickened posterior margin, floor of depression roughened and finely punctate, with a pair of oblique anterior grooves meeting centrally in disc depression, meso- and metanotum finely punctate; anteroventral margin of front femur with 2–3 (rarely 4) large spines basally and very small almost obsolete spine distally, posterior margin with a large distal spine.

Abdomen. T2–6 weakly punctate to punctate laterally, very finely punctate medially; posterior margin of T6 thickened laterally producing a very broadly rounded ridge continuing to lateral margin (Fig. 9G), laterocaudal angle slightly produced into a very small caudally directed spine (Fig. 9E); T7 punctate, laterocaudal angle produced into an acute oblique spine directed ventrocaudally (Fig. 9E); supraanal plate punctate, anteromedial margin smooth, laterocaudal angle slightly produced forming a broadly rounded obtuse spine directed caudally, posterior margin weakly crenulate; S2–6 punctate laterally, S3–6 sparsely and finely punctate posteriorly and anteromedially, broadly rounded and concavely truncated posteriorly exposing subgenital plate; subgenital plate finely punctate; cerci bulbous and densely setaceous ventrally except on apical tip, dorsal surface nonsetose and with a medial ridge basally, posterior margin concave (Fig. 9E); genitalia well developed, L2d absent, L2vm and L1 present, R2 developed into a strong sclerotised hook (Fig. 9A).

Female

Differs from male as follows: pronotum with weaker premarginal tubercles, disc less depressed; S7 broadly rounded but not concavely truncated posteriorly; subgenital plate absent; slightly larger than male.

Measurements. Total length 41.3–42.4, pronotal length x width 10.0–10.5 x 15.5–16.5.

Nymph

Similar to adults but without adult pronotal characters.

DISTRIBUTION AND BIOLOGY

Known only from the type locality in fairly heavy loam with *Eucalyptus* and *Callitris* forest; not abundant. The soil is usually hard and the burrows shallow.

REMARKS

Shaped like *P. gigantea* it is darker and lacks the row of spines on the sixth tergite.

ETYMOLOGY

Latin *saxum*, rock and *-cola*, dweller.

Neogeoscapheus barbarae sp. nov.
(Fig. 11)

MATERIAL EXAMINED

HOLOTYPE: ♂ 1km S of Brigooda, 26°15'S 151°25'E, dug up, 25.i.1992, HAR, QM.

PARATYPES: 1 ♂, 1 ♀, 'Marshlands' 12km N of Hivesville, dug up, 25.ii.1988, HAR, DR, JRW, ANIC; 1 ♂, 1 ♀ same data as holotype, QM; 1 ♂, 'Marshlands' 12km N of Hivesville, dug up, 25.ii.1988, HAR, DR, JRW, QM.

OTHER MATERIAL. Queensland: 13 ♀, 10 ♀, 3 ♂ nymphs, 3 ♀ nymphs, same data as 'Marshlands' paratypes, USIC; 1 ♂, 2 ♀, 2 ♂ nymphs, 3 ♀ nymphs, same data as holotype, USIC.

DESCRIPTION

Male

Colour. Head and thorax very dark brown to black; pro-, meso- and metanotum slightly ferrugineous posteriorly; tuberculate areas of pronotum black; legs black, tarsi and ventral surface of meso-and metafemurs ferrugineous; tergites black; S1–6 shiny black laterally, ferrugineous medially; S7 black, ferrugineous anteromedially; subgenital plate black, posterior margin often ferrugineous; cerci dark brown, light brown apically; dorsal and ventral surfaces shiny.

Measurements. Total length 44.6 (42.7–53.6), pronotal length x width 12.2 x 19.5 (11.7–15.3 x 17.3–22.2).

Head. Punctate, hidden under pronotum, frons slightly depressed between antennal sockets.

Thorax. Pronotum convex, subsemicircular, anterior margin slightly indented medially, with a medial premarginal thickening forming a pair of broad transverse tubercles which are slightly

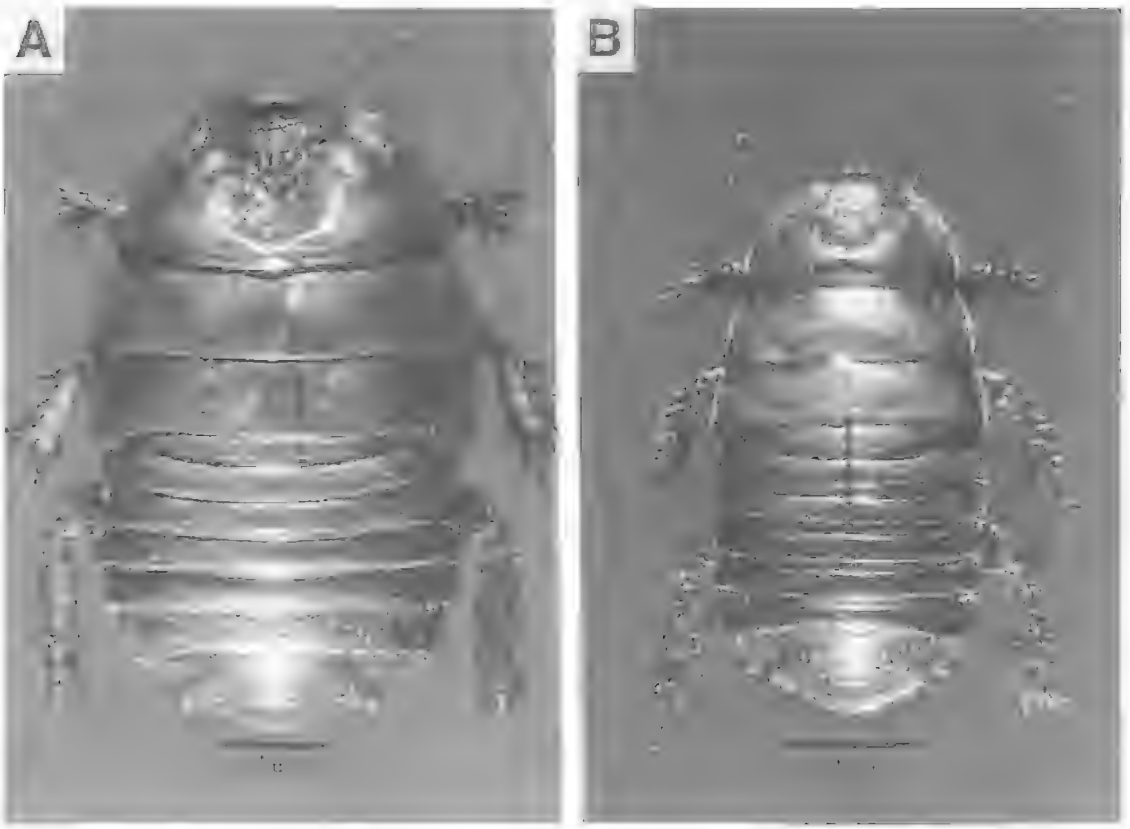

FIG. 10. A, *Macropanesthia rothi* sp. nov., holotype ♂: B, *Macropanesthia saxicola* sp. nov., holotype ♂. A,B, habitus, dorsal view.

recurved (Fig. 11D); disc depressed posterior to tubercles to 2–3mm from posterior margin, floor of depression transversely striate behind anterior tubercles and anterior to a pair of oblique anterior grooves, a pair of feeble separated disc tubercles present posterior to oblique grooves, remainder of pronotum punctate, punctations slightly stronger and denser anterolaterally; meso- and metanotum finely and sparsely punctate; anteroventral margin of front femur with 2–3 (rarely 4) large spines basally and small distal spine, posterior margin with a large distal spine.

Abdomen. Tergites weakly punctate, punctations denser laterally; laterocaudal angle of T6 not produced, posterior margin with a large acute spine 3mm from the lateral margin (Fig. 11E), spine often blunt; T7 punctate, punctations larger and denser medially, laterocaudal angle produced into a spine directed laterally and slightly reflexed dorsally (Fig. 11C); supraanal plate punctate, laterocaudal angles produced obtusely, posterior margin smooth and slightly upturned; sternites punctate, punctations weak anteromedially, stronger and denser laterally; S7 broadly rounded, with a shallow concave truncation exposing subgenital plate; subgenital plate weakly punctate posteriorly; cerci bulbous tapering to an acute rounded tip, proximal half with a dorsal medial ridge, densely setaceous ventrally except along apical margins, dorsal surface nonsetose; genitalia well developed, L2d absent, L2vm and L1 present, R2 developed into a strong sclerotised hook (Fig. 11B).

Female

Differs from male as follows: pronotum with premarginal thickening greatly reduced, tubercles absent, disc slightly depressed in anterior half only; subgenital plate absent; sternite 7 broadly rounded but not concavely truncated posteriorly.

Measurements. Total length 40.7–51.7, pronotal length x width 11.0–12.9 x 17.5–19.9.

Nymph

Similar to adults but without adult pronotal

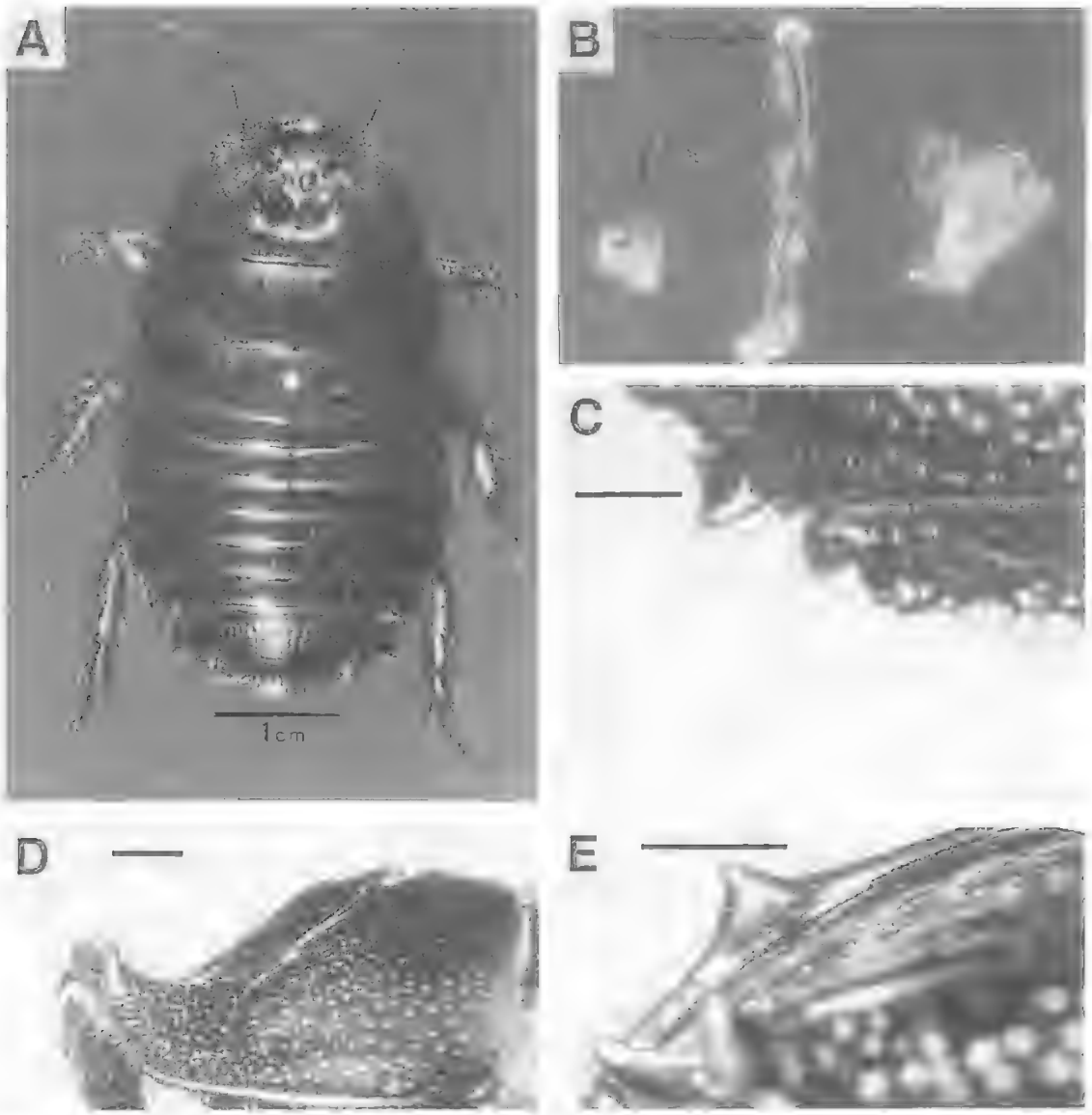

FIG. 11. *Neogeoscapheus barbarae* sp. nov., holotype ♂. A, habitus, dorsal view; B, genitalia, R2-L2vm-L1; C, lateral margins of T7 and supraanal plate, dorsal view; D, pronotum, lateral view; E, lateral portion of posterior margin of T6, posterior view.

characters (anterior tubercles and depressed disc).

Distribution and Biology

Two populations of this species are known from SE Queensland. The type locality near Brigooda is in softwood scrub with scattered evergreen vine thickets on a brown to red loam. The 'Marshlands' population lives in a similar habitat.

Remarks

Similar to *N. hirsutus* (Shaw) but distinguished by a well produced spine on the posterior margin of T6, rather than a rounded tubercle. It is also darker in colour than *N. hirsutus*.

Etymology

For Barbara Rose, wife of H. A. Rose, and who has been involved with research into soil burrowing cockroaches since 1975.

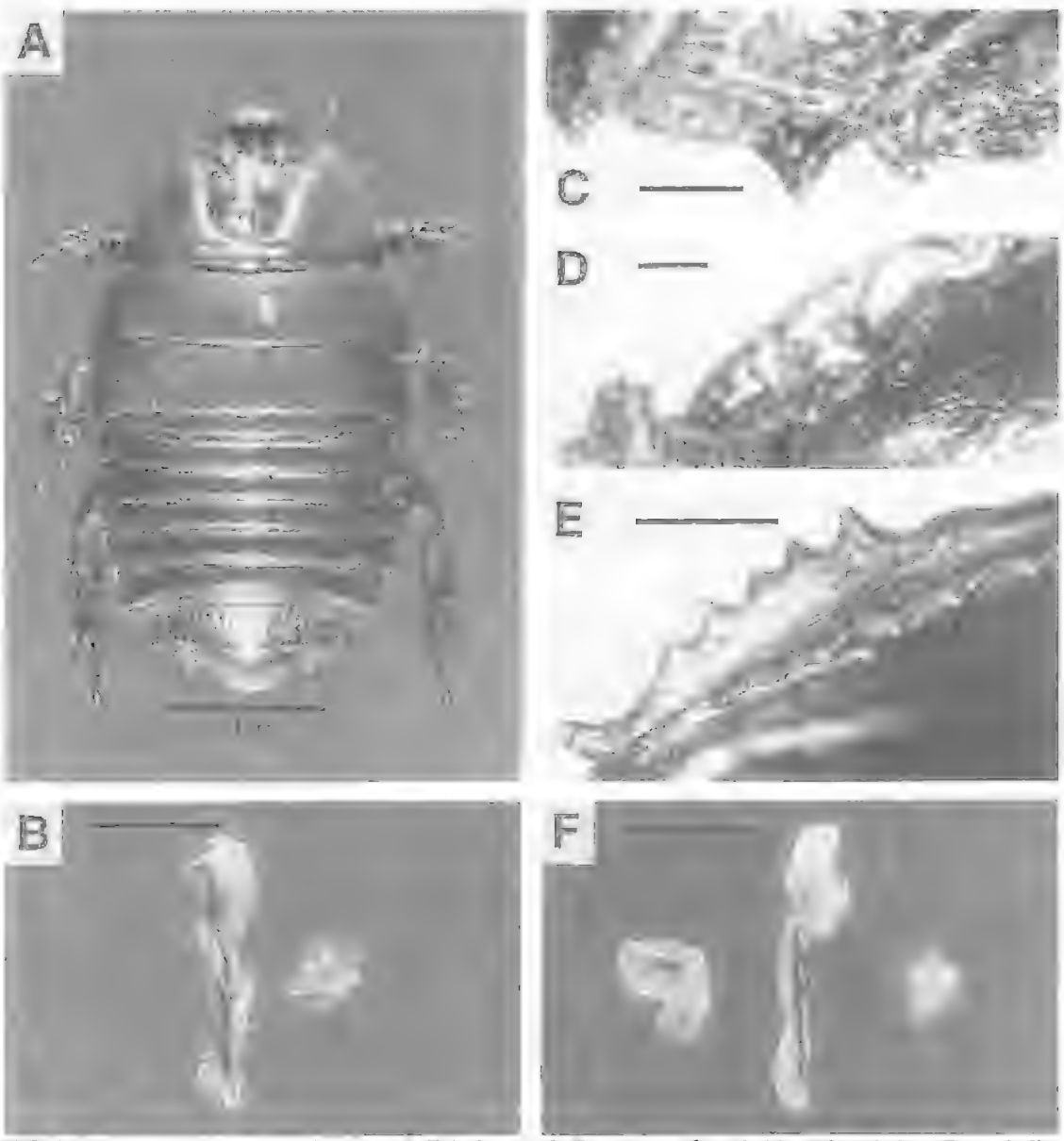

FIG. 12. *Parapanesthia pearsoni* sp. nov. A-E, holotype ♂; F, paratype ♂. A, habitus, dorsal view; B, genitalia, L2vm-L1; C, laterocaudal angle of T6, lateral margins of T7 and supraanal plate; D, pronotum, lateral view; E, lateral portion of posterior margin of T6, posterior view; F, genitalia, L1-L2vm-R2.

Parapanesthia pearsoni sp. nov.
(Fig. 12)

MATERIAL EXAMINED

HOLOTYPE. ♂, Blackdown Tableland, Dawson Range, 23°49'S 149°06'E, dug up, 15.xii.1986, HAR, DR, JRW, QM.

PARATYPES: 1 ♂, 1 ♀, Blackdown Tableland, Dawson Range, 23°49'S 149°06'E, dug up, iv.1988, HAR, ANIC; 1 ♂, 1 ♀, Blackdown Tableland, Dawson Range, 23°49'S 149°06'E, dug up, 26.iv.1992, BRR, HAR, JAW, JRW, QM.

OTHER MATERIAL: 1 ♀, 1 ♀ nymph, Blackdown Tbld. Oct. 1985, S. C. Pearson, QM; 2 ♂, 3 ♀, 1 ♂ nymph, Blackdown Tableland, Dawson Range, 23°49'S 149°06'E, dug up, iv.1988, HAR, USIC; 2 ♂, 2 ♀, 1 ♂ nymph, 4 ♀ nymphs, data as for holotype, USIC; 3 ♂, 2 ♀, 8 ♂ nymphs, 9 ♀ nymphs, Blackdown Tableland, Dawson Range, 23°49'S 149°06'E, dug up, 26.vi.1992, BRR, HAR, JAW, JRW, USIC.

DESCRIPTION

Male

Colour. Head black, clypeus brown; pronotum black, ferrugineous laterally; meso- and metanotum ferrugineous to black; legs very dark brown to black, spines black apically, posteroventral surface of meso- and metafemur ferrugineous to tan; T1–6 very dark brown to black; T7 and supraanal plate black; S1–6 black, ferrugineous anteromedially, subgenital plate black; cerci dark brown to black; dorsal and ventral surfaces shiny.

Measurements. Total length 54.4 (51.4–52.4), pronotal length x width 16.7 x 24.4 (15.2–15.9 x 23.0–23.8).

Head. Punctate, hidden under pronotum, frons weakly striate transversely and slightly depressed between antennal sockets.

Thorax. Pronotum convex, subsemicircular, anterior margin with a medial premarginal thickening forming a pair of broad transverse tubercles which are slightly recurved (Fig. 12D), anterior margin may be feebly indented medially; disc depressed posterior to tubercles to 2–3mm from the medially thickened posterior margin, floor of depression transversely striate behind anterior tubercles and anterior to a pair of oblique grooves, pronotum with fine sparse punctations; meso-and metanotum finely and sparsely punctate; anteroventral margin of front femur with 3–4 (rarely 2) large spines basally and a small distal spine, posterior margin with a large distal spine.

Abdomen. Tergites punctate, punctations stronger and denser laterally; laterocaudal angle of T6 produced laterally into an acute oblique spine, slightly reflexed dorsally; posterior margin of T6 with 4–6 (rarely 3 or 7) irregular erect teeth laterally (Fig. 12E); T7 strongly punctate, laterocaudal angle produced into a short slightly upturned oblique spine (Fig. 12C), posterior margin may or may not possess 2 or 3 small teeth laterally in a similar position to those on T6; supraanal plate strongly and densely punctate, laterocaudal angles slightly produced obtusely, posterior margin smooth or weakly undulate and slightly upturned; S1–6 weakly punctate medially, punctations stronger and denser laterally; S7 broadly triangular, concavely truncated posteriorly exposing subgenital plate; cerci bulbous, tapering to a broadly rounded tip, proximal half with a dorsal medial ridge, setaceous ventrally except apically and on anterior margin, dorsal surface nonsetose; genitalia slightly reduced, L2d absent, L2vm present, L1 weak, R2 reduced to a mound (Fig. 12B,F).

Female

Differs from male as follows: pronotum with premarginal thickening reduced, tubercles almost obsolete, disc depressed for anterior half only, posterior margin hardly thickened; subgenital plate absent; S7 not concavely truncated posteriorly.

Measurements. Total length 46.2–51.4, pronotal length x width 12.4–13.4 x 20.2–20.6.

Nymph

Similar to adults but without adult pronotal characters (anterior tubercles and depressed disc). Tubercles on posterior margin of T6 less produced than in adults.

DISTRIBUTION AND BIOLOGY

Known only from type locality in *Eucalyptus* forest on a fine grey to black loam.

REMARKS

The holotype has the R2 genital phallomere missing (Fig. 12B). Desiccation and hardening of the specimen made dissection of genitalia difficult. It is likely that the R2 phallomere was lost during dissection as all other male specimens examined possessed this sclerite. *P. gigantea* is much smaller than this species and not as dark.

ETYMOLOGY

For Steve Pearson, a ranger at Blackdown Tableland National Park, who discovered the species.

DISCUSSION

Geoscapheinae are concentrated in SE Queensland (10 of 19 species are found only in SEQ). Some live within a few km of each other but are not sympatric. Populations of *G. dilatatus* and *G. robustus* from some semi-arid regions of Queensland, New South Wales and South Australia are known to be sympatric. *M. kraussiana* and *G. dilatatus* also occur in sympatry near Cobar and south of Broken Hill.

Generic assignment was difficult in some cases. *P. pearsoni* sp. nov. and *N. barbarae* sp. nov., for example, fit into existing genera easily but others have features of more than one genus. This is also reflected by the wide differences in male genitalia, in contrast to the rest of the Blaberidae. Genitalia are generally considered to be conservative with respect to evolution and show little diversification (McKittrick,1964).

However, the Geoscapheinae are a clearly defined group, all being similar in gross morphology, ecology and behaviour. Perhaps genera may not reflect phylogeny? Further studies of intergeneric relationships are needed.

ACKNOWLEDGEMENTS

We thank museum curators for loan of specimens, in particular Dr Geoff Monteith, Queensland Museum, whose keen interest led to discovery of several new species. We also thank Malcolm Ricketts for help and advice with photography, and Andrew Kotze, Barbara and Matthew Rose, Laurie Sanchez and Jim Woodward, who assisted in collection of specimens. Funding from the Australian Research Council to H. A. Rose is gratefully acknowledged.

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HIMANTURA FAI JORDAN & SEALE (MYLIOBATIFORMES: DASYATIDIDAE) FROM HERON ISLAND AND ITS MONOGENEAN PARASITE FAUNA

IAN D. WHITTINGTON AND PETER R. LAST

Whittington, I.D. & Last, P.R. 1994 06 01: *Himantura fai* Jordan & Seale (Myliobatiformes: Dasyatididae) from Heron Island and its monogenean parasite fauna. *Memoirs of the Queensland Museum* 35(1): 285-289. Brisbane. ISSN 0079-8835.

Close examination of a host stingray identified formerly as *Himantura uarnak* (Forsskål) from Heron Island, Queensland, Australia reveals it instead to be *H. fai* Jordan & Seale, a species not previously recorded from Australian waters. A diagnosis is given for this ray, along with information on its distribution and features which distinguish *H. fai* from other *Himantura* species found in the Great Barrier Reef. Previous records of its monogenean parasite fauna are clarified to avoid further confusion. *Himantura uarnak, H. fai, elasmobranch ray, Myliobatiformes, Dasyatididae, Heron Island, Monogenea, parasites.*

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A checklist of parasites from Heron Island (23°27'S, 151°55'E) in the Great Barrier Reef, Queensland, Australia (Lester & Sewell, 1989) included data on parasites from 122 species of fish. Their manuscript was compiled largely by parasite taxonomists participating in a week-long workshop in 1986 at the Heron Island Research Station of the University of Queensland (see Lester & Sewell, 1989). Subsequently, the island was visited by one of us (IDW) five times between 1987 and 1991 to collect material for parasite studies. During this period, 30 specimens were dissected and additional photographs were taken or acquired of a stingray (Dasyatididae) listed by Lester & Sewell (1989) as *Himantura uarnak* (Forsskål,1775). Most of these specimens were caught using a beach seine at Shark Bay, Heron Island, on a rising tide in the afternoon and in water no deeper than 1.5m. After initially examining colour transparencies of specimens, one of us (PRL) concluded that the host species had been misidentified. Later, two frozen intact females (disc widths approximately 63 and 76cm) and the claspers and tail of a mature male (disc width approximately 78cm) were sent to Hobart to be positively identified.

The dasyatidid genus *Himantura* Muller & Henle is widely distributed in the Indo-Pacific region with two additional species in the western Atlantic and eastern Pacific. In the absence of a recent revision, group members are frequently misidentified. Compagno & Roberts (1982), in describing a new species of *Himantura*, recognised 18 valid species. However, a revision in progress by one of us (PRL, unpubl. data), has found that the taxon is polyphyletic and consists of several species complexes. The synonymy scheme proposed by Compagno & Roberts appears to be conservative.

Members of a complex of species with prominent dorsal colour patterns of spots and/or reticulations are frequently misidentified as *Himantura uarnak*. In addition, some plainly coloured species, such as *Himantura fai* Jordan & Seale, 1906 also appear to have been confused with *H. uarnak*. Although specimens of *H. fai* are known from Australian waters, these reports have not been documented. *H. uarnak* and *H. fai* are widely distributed in the tropical Indo-Pacific, and both species are likely to occur off Heron Island. Among other characters, their dorsal colorations are diagnostic and, if taken together, they are highly unlikely to be regarded as conspecific even by non-taxonomists. The frozen specimens and photographs of the hosts from which parasites were taken at Heron Island are *H. fai* rather than *H. uarnak*. Data on the Heron Island specimens are provided herein along with distinguishing features from other local *Himantura* species. In addition, the records of its monogenean parasite fauna are clarified to avoid further confusion.

MATERIALS AND METHODS

Standard morphometric data were obtained from two female specimens of *Himantura fai* from Heron Island (registration numbers of

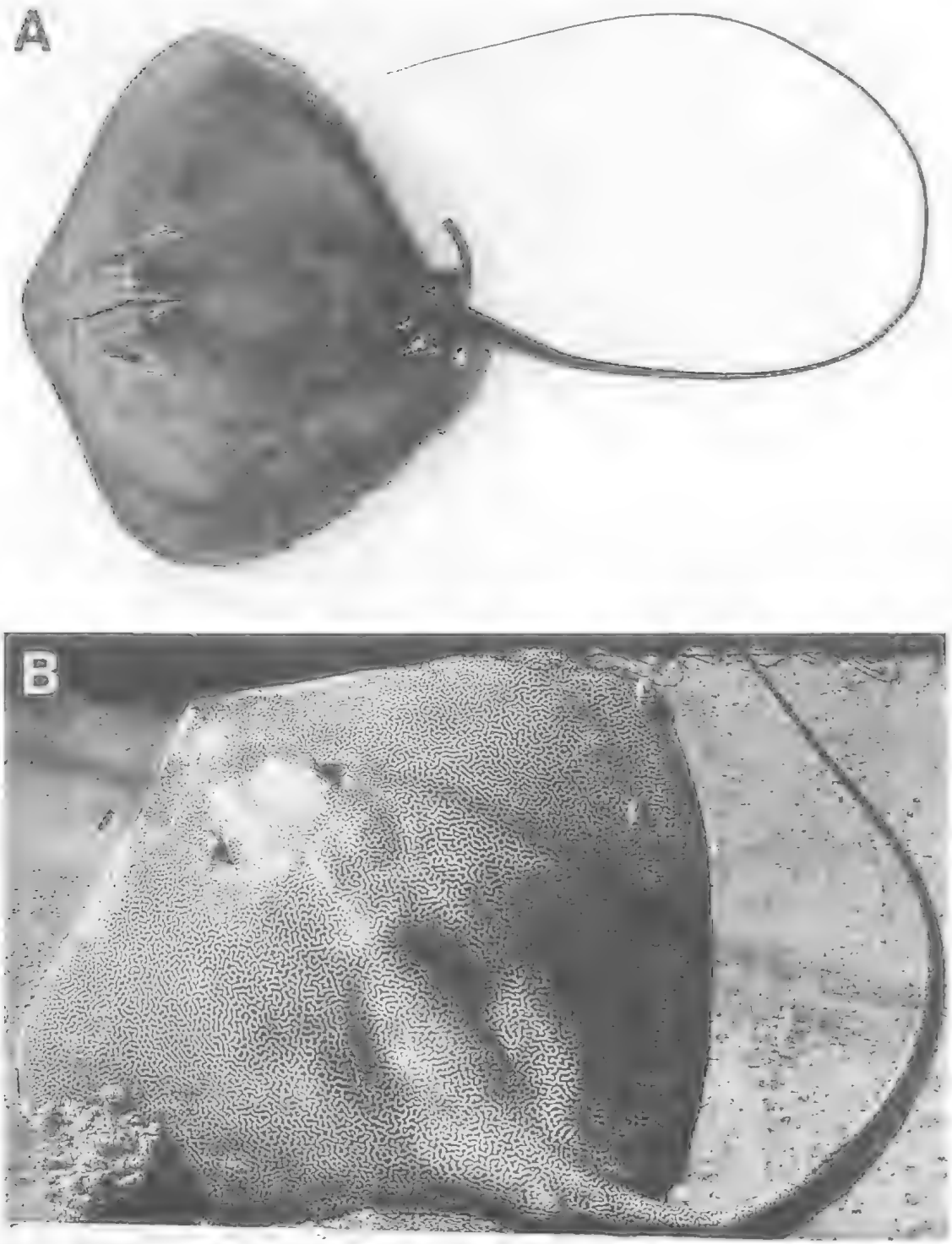

FIG. 1. A, *Himantura fai* (disc width, approximately 76cm) from Heron Island; B, *Himantura uarnak* (disc width, approximately 1.8 m) from north-western Australia, a species with which *H. fai* has been confused at Heron Island.

TABLE 1 – The known species of monogenean parasites from *Himantura fai* (formerly identified as *H. uarnak)* at Heron Island, Queensland, Australia

Species	Site on host	Refs	Reg. details of present material
Thaumatocotyle australensis	Nasal cavities	B&W	G210092-125 (34 slides)
Monocotyle helicophallus	Gills	M	G210051-78 (28 slides)
M. multiparous	Gills	M	G210079-91 (13 slides)
M. spiremae	Gills	M	G210021-50 (30 slides)

B&W = Beverley-Burton & Williams (1989)
M = Measures et al. (1990)

specimens: CSIRO H2753-01 & H2754-01; 629-764 mm disc width, 23°27'S, 151°55'E, Shark Bay, Heron Island, Great Barrier Reef, collected by I.D. Whittington using beach seine, depth: 1.5m, February 1991) which are now held in the I.S.R. Munro Ichthyological Collection, Hobart, Australia.

SYSTEMATICS

Himantura fai Jordan & Seale, 1906

DIAGNOSIS

Disc quadrangular, robust centrally, slightly wider than long, apices broadly rounded; snout very broad, tip feebly pointed; eyes small, length of eye and spiracle about 2.6-3.0 in preorbital snout length; interorbital space broad. Mouth rather small, 4 papillae on floor (central pair enlarged, lateral pair minute). Head and trunk entirely smooth in juveniles, mostly smooth in adults apart from band of low, flat, widely spaced, heart-shaped denticles extending from interorbital region posteriorly over centre of disc and onto midline of tail; no enlarged thorns on body or tail. Tail very long, whip-like, almost cylindrical anteriorly, lacking cutaneous folds. Uniformly brownish pink on dorsal surface, whitish ventrally, tail black beyond stinging spine. Attaining a large size (disc width exceeding 1.5m, greater than 5m total length).

MORPHOMETRICS

The following measurements are expressed as a percentage of disc width. Total length 277.1-298.3, disc length 84.3-88.1, snout to maximum width 34.0-36.4, distance snout to axil of pectoral fin 74.0-77.1, disc thickness 11.3-12.1, snout preorbital 21.1, snout preoral 19.1-19.5, snout prenasal 14.9-15.3, head length 38.6-39.3, snout to origin of cloaca 71.5-73.6, cloaca to sting 30.5-31.3, cloaca to tail tip 200.1-220.7, orbit diameter 4.1-4.2, eye diameter 2.6, interorbital width 12.0-13.5, orbit and spiracle length 7.1-7.7, spiracle length 4.8-5.5, distance between spiracles 14.8-15.4, mouth width 6.5-7.5, distance between nostrils 8.4, nostril length 4.2-4.3, nasal curtain length 4.9-5.1, width 1st gill slit 2.6-2.7, width 5th gill slit 2.2-2.3, distance between 1st gill slits 17.1-18.0, distance between 5th gill slits 11.4-12.1, length pelvic fin 13.0-14.8, width across pelvic-fin base 8.0-8.9, tail width at axil of pelvic fins 4.9-5.0, tail height at axil of pelvic fins 4.3-4.7, tail width at base of sting 1.8-1.9, tail height at base of sting 2.1.

DISTRIBUTION

Indian Ocean from South Africa to the Caroline Islands. In Australian waters, known from the inner continental shelf off tropical Australia from Shark Bay, Western Australia to Bundaberg, Queensland.

OTHER *HIMANTURA* SPECIES OCCURRING NEAR HERON ISLAND

Misidentification of *Himantura fai* from Heron Island has undoubtedly resulted from the poor state of published information on the group. Woodland & Slack-Smith (1963) reported the occurrence of *H. granulata* (Macleay, 1883) (as *Dasyatis granulatus*) from Heron Island. Goeden (1974), in a revised list of fishes of the Heron Wistari Marine National Park, listed only a single species of *Himantura* (*H. uarnak* as *Hymantena narnak*). In a more recent checklist of fishes of the Capricorn-Bunker Group, Russell (1983) reinstated *H. granulata*. It is likely, based on unpublished catch information from nearby, that *H. undulata* (Bleeker, 1852) and *H. toshi* Whitley, 1939, may also occur within the park boundary. *H. fai* differs from *H. uarnak*, *H. undulata* and *H. toshi* in being plain coloured with a black tail (rather than being covered in a pattern of black spots, ocelli or reticulations and having a banded tail). Fig. 1 shows a specimen of *H. fai* from Heron Island and a specimen of *H. uarnak* from north-western Australia to show the differences in dorsal markings. *H. granulata* is usually covered in fine white flecks and spots (rarely plain coloured) and has a whitish tail.

PARASITE FAUNA OF *HIMANTURA FAI*

Lester & Sewell (1989) listed three species of monogeneans from '*Himantura uarnak*' at Heron Island but only one of these was identified to species level, namely *Thaumatocotyle australensis* Beverley-Burton & Williams, 1989 from the nasal cavities. The other monogeneans listed were given as *Heterocotyle* sp. and *Monocotyle* sp., each from the gills, and are records ascribed to Dr M. Beverley-Burton (University of Guelph, Canada). The record for *Monocotyle* sp. has since been presented as three separate species by Measures et al. (1990), namely *M. helicophallus*, *M. multiparous* and *M. spiremae*. From November 1987 to February 1991, a total of 30 specimens (23 females, 7 males; disc widths 53-89cm) of the stingray in question were examined by IDW for monogeneans and specimens of most (and often all) of the parasite species listed above were found on 26 of the stingray specimens examined. Voucher specimens of each of these monogenean species from *H. fai* have been deposited at the Queensland Museum (Brisbane, Australia) and the registration details are presented in Table 1. The checklist of Lester & Sewell (1989) should be amended to attribute *Himantura fai* Jordan & Seale, 1906 as the host species for the monogeneans listed in Table 1. A *Heterocotyle* sp. from the gills recorded in Lester & Sewell (1989) is thought to be a new species and will be described in a later publication. Two other undescribed species of capsalid monogeneans belonging to the subfamily Benedeniinae have also been found from the skin of *H. fai* and these will be described by the senior author.

The checklist of Lester & Sewell (1989) also lists several cestodes from the intestine of '*H. uarnak*' based on identifications by Professor H.H. Williams (Open University, Wales). These parasite records were not verified in the present study but, as they were probably collected along with the monogeneans described by Measures et al. (1990), it seems likely that the cestodes listed in Lester & Sewell (1989) from '*H. uarnak*' belong to *H. fai*.

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